Profile of the American oyster (*Crassostrea virginica*)

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Glossary

Approved area (uncontaminated area):
The classification of a shellfish growing area which has been approved through a sanitary survey of the water by the shellfish control authority for growing or harvesting shellfish for direct marketing. The sanitary survey of this area indicates that even under adverse conditions, wastewater effluent from neighbouring areas does not represent a risk to public health. (In those areas, the median or geometric mean faecal coliform Most Probable Number (MPN) of the water does not exceed 14/100 mL, and not more than 10% of the samples exceed a faecal coliform MPN of 43/100 mL.)

Conditionally approved area:
The classification of a shellfish growing area determined by the shellfish control authority to be conditionally approved. This area has the same sanitary quality as approved areas, however, the quality varies with (A) the effectiveness of sewage treatment at a community, (B) Rainfall or river flow, (C) Seasonal changes in sanitary conditions (i.e. tourist or summer cottage activity, vessel traffic, seasonal industrial operation). The area has to meet approved area criteria for a predictable period, which the period is conditional upon meeting established performance standards specified in a memorandum of understanding signed by the parties concerned.

Aquaculturists (oyster growers or producers):
holders of shellfish leases in the provinces of New Brunswick, Nova Scotia or Prince Edward Island, who grow their own oysters from spat/seed collected.

Closed area (contaminated area):
A bivalve shellfish growing area where the harvesting of shellfish is temporarily or permanently not permitted due to water contamination, except by special licence for specific purposes such as depuration, relaying, and experimental purposes.

Commercial fishery:
Harvesting of commercial-size oysters (76mm) for immediate marketing.

Decontamination:
The process of effectively reducing the level of bacteria and viruses consists in placing contaminated oysters in an area of clean water for a minimum of 14 days at a temperature over 5° C.

Depuration (or controlled purification):
The process of using a controlled, aquatic environment to reduce the level of pathogenic (unwanted) bacteria and viruses in live shellfish.

Integrated Fisheries Management Plans:
Plans that are designed to outline the conservation regarding the sustainable use of fisheries resources. They are based on scientific knowledge, as well as conservation and protection measures and integrate the various DFO sectors, as well as encourage input by all stakeholders. These Integrated fisheries management plans give rise to co-management which ensure transparency, establish all allocations between sectors and fleets, provide relevant information in context, and ensure that clients and stakeholders are consulted on the comprehensive strategies and objectives for management of each fishery.

Lease:
The precise definition of the term lease may vary somewhat between provinces. In general however, a lease usually ensures the right to exclusive use of a property for a period of time and for a specified specie and give the leasee exclusive rights to the cultured specie.

Relaying (oysters):
Process whereby oysters harvested in a bacteriologically contaminated area (closed area) are transferred to an approved area (clean waters) for natural biological cleansing.

Seed (oyster):
Any sub-market size oysters (bigger than spat and usually less than 51 mm).

Spat (oyster):
Oyster larva after it has excreted a tiny pool of cement-like adhesive to settled on a clean and hard surface.

Statistical district or area:
A geographical division of the managed area (see Appendix 3 for list of statistical districts).

Value at landing:
Cash value of the harvested fish species recorded upon landing. i.e. the quantity of marketable oysters landed multiplied by the price per unit of measure or the value indicated by the buyer.

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Executive Summary

The purpose of this profile is to provide an overview of the American oyster's (*Crassostrea virginica*) wild fishery and aquaculture activities presently in place in the Gulf Region.

Chapter One describes the habitat and general biology of the *C. virginica*, which is a specie of shellfish classified as a bivalve mollusc. In the Gulf Region, American oysters are restricted to the warm, shallow bays and estuaries of the southwestern Gulf of St.Lawrence and are usually found attached to hard substrate such as rocks or shells. They feed on plankton, which are microscopic plants and animals present in the water column. In the Gulf Region, their growth period is usually from May to late November with a recess in July for spawning. Predators, other species competing for space and food, diseases, adverse environmental conditions, and certain micro-organisms can impair the quality of the oyster and may contribute to oyster mortality.

Chapter Two describes the principal methods of collecting oysters, which include mainly the use of rakes and tongs operated by hand from a small vessel. It also describes the principal operations involved, such as site selection, seed collection and cultivation of the two types of oyster culture, which are off-bottom culture (in suspension) and bottom culture. Small oysters can be gathered from public beds to be transferred on private leases by the aquaculturists themselves or by purchasing the seeds from commercial fishers. Aquaculturists can also choose to collect their own spat from collectors on leases. After having collected the oyster seeds, the bottom culture method consist of carefully spreading them directly on the bottom, or in protective materials, such as vexar mesh bags, on bottom racks. There are different suspended methods, such as rafts, floating longlines, and fences, and more recently for cocktail oysters, floating bags placed on the water surface.

Chapter Three lists the authorities responsible for the management of the commercial oyster fishery and of aquaculture and describes the principal oyster management measures in the Gulf Region such as seasons, which include a Fall fishery in uncontaminated waters (approved areas) and a Spring fishery in contaminated waters. Other management measures include licensing for the commercial fishery and spat collection, as well as leasing for individuals or company wanting to be granted a lease to grow oysters or to relay them from contaminated areas for depurification.

Chapter Four highlights data on licences, leases, employment, oyster landings, and markets, as well as provides some statistical analysis of the oyster industry. In the Gulf Region there are 3,929 oyster licences issued to close to 3,200 fishers. There are also 1,433 private oyster leases covering 5,753 hectares, which 47% are located in PEI, 44% in Eastern NB, and 15% in Gulf NS. These leases are granted to 677 leaseholders, of which it is estimated that 415 are also registered fishers. Moreover, these leaseholders employ close to 200 people on their oyster aquaculture operations.

The American oyster with 2,949 metric tons of landings valued at $7.6 Million in 2001 is the second most important molluscs landed and cultured in the Gulf Region. According to Canadian fish inspection regulations, oysters must be bought and sold according to specific grades, namely Fancy, Choice, Standard and sub-standard or commercial. For the most part, they are sold fresh in the shell directly to registered provincial and/or federal buyers. The Gulf Region has a well-established market in Canada, selling the bulk of its oyster production in Montreal, Quebec and Toronto. In the last five years however, increasingly more oysters are being exported, principally to the U.S.

Chapter Five lists some of the Gulf Region's aquaculture and bivalve shellfish research and education programs, as well as facilities supporting their development.

In *Conclusion*, the profile highlights the importance of the American oyster for the Gulf Region.

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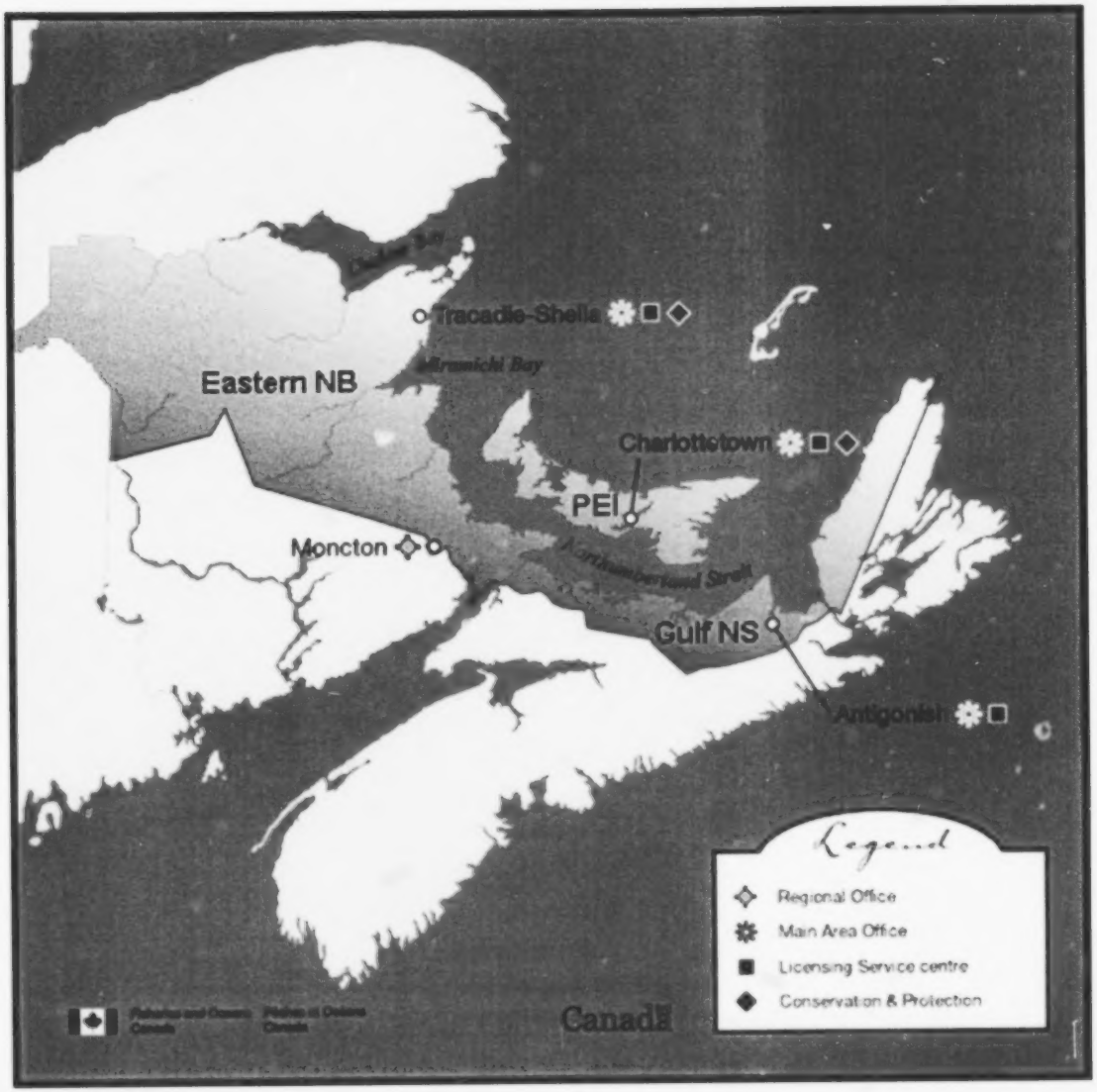
Introduction

The following profile provides an overview of the American Oyster wild fishery and aquaculture activities occurring in the Gulf Region (Figure 1). The Department of Fisheries and Oceans Canada (DFO) gave the Gulf Region the responsibility to manage the distinct entity of the southern Gulf of St.Lawrence. The Region comprises all the waters of the Gulf adjacent to the eastern coast of New Brunswick (Eastern NB), the Northumberland Strait coast of Nova Scotia (NS) and western Cape Breton Island known as Gulf NS, as well as the whole of Prince Edward Island (PEI).

Figure 1. Gulf Region (in dark)

In 1995, Cabinet endorsed the *Federal Aquaculture Development Strategy* (FADS), invigorating the federal government's commitment to aquaculture development and affirming the role of DFO as the lead federal agency in this regard. The definition adopted in the FADS is the one prompted by the United Nations Food and Agriculture Organization (FAO), which is:

> *"Aquaculture is the culture of aquatic organisms, including fish, molluscs, crustaceans and aquatic plants. Culture implies some form of*



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human intervention in the rearing process to enhance production, such as regular stocking, feeding, protection from predators, etc. Culture also implies individual or corporate ownership of the stock being cultivated."

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Chapter 1 – General Characteristics of the American Oyster

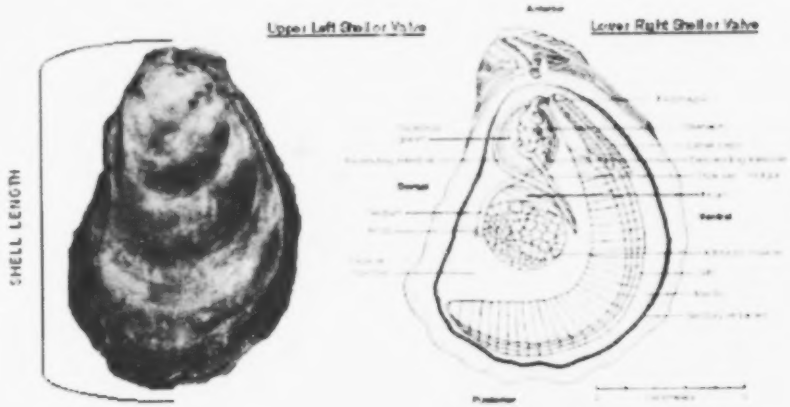
The American oyster (also called eastern oyster), *Crassostrea virginica* is the commercial oyster of the Canadian Maritime Provinces, as well as of the Atlantic and Gulf of Mexico coasts of the United States. Small quantities also occur on the Pacific coast, where it was introduced. On the East Coast, there are very few commercial oysters along the Atlantic coast of NS and none in the Bay of Fundy because water temperatures in those coastal areas, among other environmental factors, are generally too cold for oyster reproduction and growth. Excluding oyster beds in the coves of Cape Breton's Bras d'Or Lakes, oysters are mostly concentrated in the Gulf Region. They are found in the warm, shallow bays, and estuaries of the southern and western parts of the Gulf of St. Lawrence and Northumberland Strait.

1.1 Habitat

The American oysters are found attached to hard substrate such as rock or shells on the floor of brackish bays, coves and estuaries, sometimes in great clusters. The highest-grade (best quality) oysters come from areas where the bottom is firm and non-shifting. Their preferred range of water salinity lies between 20 to 27 ppt, which include bays into which rivers flow, as well as river estuaries, into which salty tides ebb and flow.

1.2 Biology

Figure 2. American Oyster (*Crassostrea virginica*)



Source : Maryland Sea Grant.

Click on the image for a full size version

Figure 2 shows the shells and parts of the oyster body mentioned in this text. The American Oyster is a bivalve mollusc consisting of a soft body enclosed between two calcareous shells, or valves, joined together by a tough ligament along a narrow hinge line. Generally speaking, the shell of the American oyster is thick and has a rough, sculptured appearance. Its colour varies but is mainly a mixture of brown, gray, green, and white shades. The two valves of the oyster are asymmetrical - the lower one is cupped to accommodate the body and the area where the oyster attaches to the substrate, while the upper is flat and acts like a lid. A large adductor muscle, attached to both shells at a point slightly off centre, controls the shells opening and closing. The thickness and strength of the shells are highly variable to growing conditions, and together with the shape of the shell they are important to the oyster grower, who can influence them to increase financial returns.

The inside of the oyster is dull white and smooth to the touch, except for the prominent dark scar of the adductor muscle. The soft body is made up of the organs of respiration, digestion, and reproduction. Enveloping it is a sheet of tissue called the mantle, which is lined with many small, thin-walled blood vessels that extract oxygen from the water and expel carbon dioxide.

Oysters acquire oxygen much like fish, using both gills and mantle. The rate of oxygen consumption is influenced by external and internal factors. The main external factors are water temperature and salinity, levels of contaminants, and abundance of unicellular algae or other particles. Some of the internal factors affecting oxygen consumption are differences in tissue glycogen and water content, gonad condition, and the general health of the oyster.

The gills also play a major role in the feeding of the oyster by maintaining a steady water flow and filtering the water to collect food particles, while sorting and separating food from suspended solids. By ciliary action, accepted morsels pass down the alimentary tract into a pouch-shaped stomach surrounded by a digestive glad. Waste passes through a long, coiled intestine to be discharged through the rectum anus and carried outside the oyster by the exhalent current.

The gonad, a large organ responsible for producing eggs or sperm, surrounds the digestive organs. Oysters have separate sexes, but an individual oyster can change sex during its life span. At sexual maturity, fine genital canals are easily visible amongst the follicles of the gonad. Female and male structure differs only in that the follicles are filled with spermatozoa instead of eggs. Gonad size varies throughout the year and its development is affected by water temperature, salinity and depth, as well as by food supply, and the presence of pollutants.

1.2.1 Reproduction Cycle and Early Development

The sexual cycle begins with spawning, the release of eggs and sperm into the water, which is triggered by water temperature. In the Gulf Region, oysters with ripe gonads will spawn in early summer, when the water warms above temperature of 20°C (68°F). The reproductive potential of the American oyster is very high; during the spawning season, a single female, by clapping her shells gently, will puff out millions of eggs per year, and a male will release an even greater number of sperm.

After fertilization in the open water, cell division proceeds rapidly and within hours, the fertilized egg develops into a microscopic larvar. Within 24 hours, two thin valves are formed and within 48 hours the shell grows to cover its entire body and the elementary organ systems (for swimming and feeding) are formed.

The larvae develop through successive stages: straight-hinge, umboned, eyed, and mature. For about three weeks, the little larva, swims and drifts in the tidal currents, feeding on microscopic plants of the plankton community of which it is a part. The mortality rate is very high, only a small fraction of the young larvae reaches the next stage of development. When it reaches maturity (size of a grain of pepper), the oyster larvae extends a probing foot and seeks a suitable, clean, hard surface where the foot gland can eject a tiny pool of cement-like adhesive. Larvae will set on many different clean surfaces such as shells, stones, brush, metal, brick, and glass. Material put out for oysters to attach to is called cultch, the process of becoming cemented to the cultch is termed "setting", and once the larvae have set, the young oyster becomes know as oyster spat. At this point, the oyster remains immobile, feeding only on what food the water brings, unable to escape overcrowding or flee from predators.

1.2.2 Growth

Oysters feed on plankton - microscopic plants and animals present in the water. When water conditions are favorable oysters feed almost continuously and the warmer the water, up to about 26°C, the more active the feeding. When the water chills to around 4°C, feeding ceases.

In the Gulf Region, the American oyster's growth period is from May to late November with a recess in July for spawning. Oyster growth continues throughout life, but slows with age. Some oysters have attained a length of 38 cm (15 inches) and have weighed over 1.35 kg (3 lbs.). The rate of growth varies by estuary. On PEI for example, growth is fastest in Bedeque Bay at up to around 37 mm/year, it is moderate in the East River at 20 mm/year, and it is slowest in branches of Malpeque Bay at 10 mm/year. The shape and outer appearance of an oyster's shell reflect the conditions under which it was grown. Crowding produces shell distortions. On muddy bottoms and on overcrowded reefs the shells grow long and narrow. On hard, clean bottoms, where there is no overcrowding, the shells grow round, strong, and are deeply cupped, producing oysters of first-rate quality.

In the Gulf of St. Lawrence it takes an oyster from four to seven years to reach the market-length of 76 mm (3 inches) and three to four years to grow in a cocktail oyster, which is usually around 50 mm.

1.2.3 Mortality

Predators, adverse environmental conditions such as freshets or sudden overflowings of streams, prolonged exposure to freezing temperatures at low tide, heavy silt, marine plant growth, as well as many types of industrial and domestic pollution, can result in high oyster mortality.

Oysters can be destroyed throughout their growth however, smaller oysters are usually more preyed upon. The eggs and larvae can be consumed by many of the larger animals feeding on the plankton community, including their own parents. Rock crabs, gastropods, and starfish prey upon American oysters, while boring sponges and mud worms can invade the oysters' shell.

Recent aquatic invaders in the Gulf Region have become serious pests for oysters. The oyster thief (*Codium fragile tomentosoides*) is a green alga native of Japan detected in 1996 at Caribou (NS) that smothers oysters, preventing them from opening their shells to filter feed. Starved and weakened oysters are then easy targets for predators. Another invader, the clubbed tunicate (*Styela clava*), is native from the western Pacific and was reported in the Brudenell River (PEI) in January 1998. Clubbed tunicates grow in dense clump, interfering with the settlement of larvae and competing for space and food with young oysters.

Moreover, a large variety of diseases may affect the American oysters. In the Gulf Region, the best know disease is the Malpeque disease, which first appeared in Malpeque Bay (PEI) in the early 1900s, possibly following transfers of healthy seed from New England to replace overfished stocks. This serious infection devastated oyster stocks first in PEI and eventually spread to NB and NS. Today, nearly all oysters in the southern Gulf of St. Lawrence originate from a PEI stock that survived the disease and have passed on resistance to their offspring. However, recent transplants from historically unaffected sites (Cape Breton and Eel Pond, Southwest NS) have demonstrated that the agent causing the disease is still present and virulent for weaker oysters although no outbreaks have been documented since the early 1960s. The cause of this contagious disease is still under investigation by scientists.

1.2.4 Oyster-Associated Illness

Certain species of natural occurring microscopic algae that bloom under favourable hydrographic conditions can produce biotoxins, such as domoic acid. Filter-feeding molluscs such as oysters accumulate the toxins when utilizing toxic algae as a food source. The consumption of toxic mussels by human and even by predators can lead to illness and sometimes death. The toxins do not kill the oysters nor cause any discernible changes in appearance, smell, or taste that would alert oyster consumers of toxicity. As hydrographic conditions become less favourable, the bloom subsides and with time, the oysters rid themselves of the toxins and are once again safe to eat.

There are several types of illnesses caused by marine biotoxins that are connected with the consumption of contaminated shellfish. They include Paralytic Shellfish Poisoning (PSP), Amnesic Shellfish Poisoning (ASP), and Diarrhetic Shellfish Poisoning (DSP). The toxins are named for the most notable symptom they cause, i.e., paralysis, amnesia and diarrhea, respectively.

Pursuant to an international agreement signed in 1948, Canada has implemented the *Canadian Shellfish Sanitation Program* (CSSP), which is jointly administered by DFO, the Canadian Food Inspection Agency (CFIA) and Environment Canada. The CSSP has the primary objective to protect the public from the consumption of contaminated shellfish by ensuring that bivalve shellfish are harvested from waters of acceptable sanitary quality. The classification of bivalve shellfish growing waters is based on the sanitary and bacteriological water quality conditions of the area and the classifications used are approved, conditionally approved, and closed areas.

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Chapter 2 – Oyster Fishing and Oyster Culture

The American oyster has been present in the Southern Gulf of St. Lawrence for a long time. Oyster beds were likely known to the Indians and exploited when western Europeans began participating actively in the fisheries. The rate of exploitation increased and practices harmful to the fishery developed as settlement took place. Later in the 1830's, PEI passed an Act prohibiting the burning of live oysters for use as lime, and another Act limiting the fishery to residents of the colony.

Oysters were also likely the first sea animal to be transported from one area to another and cultivated as food. There is evidence that the culture of oyster in Prince Edward Island took place as early as 1865, when regulations were made for leasing by auction certain areas suitable for oyster production. Presently, the American oyster is the second most important species being cultured in the Gulf of St. Lawrence after the Blue Mussel.

2.1 Wild Commercial Fishing Methods

Harvesting methods include the use of rakes and tongs, which are permitting on all public grounds in the Gulf Region, and the use of dredge, which is only permitted in the Miramichi River in NB. Dredge fishing in this area has been operational for many years because of the depth of the water (6 feet and over) and because the oysters are inaccessible by hand raking.

Figure 3. Tonging Oysters

Tonging is one of the oldest methods utilized to harvest oysters. Both rakes and tongs have long handles with one or both heads having rows of teeth. They are operated by hand, without mechanical assistance, from oyster dories. The rakes have long slightly curved teeth and are used on oyster beds to reach depths usually around 4.3 m (14 ft), but some can reach depths up to 7.6 m (25 ft). The tongs handles are hinged about one-third of the distance up from the heads and are operated in a sissor-like fashion on level bottoms in depths up to 5.4 m (18 ft).

Figure 4. Oyster Dredge

The dredge, also called the drag, can only be used to fish for oysters at greater depths. It looks like a large rake-head backed with a bag and attached to a strong rope in place of a handle (Figure 4). It is towed over the bottom by a powered boat and hoisted by a mechanical or motor-driven device.

After harvesting, oysters are culled, cleaned and graded. Clusters are separated and undersized oysters, as well as old shells or broken oysters are returned to the beds. Packing and shipping complete the operation.

2.2 Methods of Culture

There are two types of oyster culture used in the Gulf Region: off-bottom culture (in suspension) and bottom culture. In PEI and Gulf NS, more than 80% of oyster leases are bottom leases, while in Eastern NB, a recent study showed that 86% of production in 2002 would be from off-bottom oyster culture. Both types of culture involve important operations, such as site selection, seed collection and cultivation.

2.2.1 Site Selection

The oyster aquaculturist must be very selective when choosing a site because its specific characteristics will determine the amount of capital and labour required to develop it and to overcome its limiting factors. This will ultimately determine the success or failure of the aquaculture enterprise. Factors such as the types of bottom, water depth, tidal action, shelter from excessive wind and wave action, ice formation, and movement are all important to take into consideration when selecting a site for spat collection or growing oyster. Temperature cycles and climate of the water are the most critical.

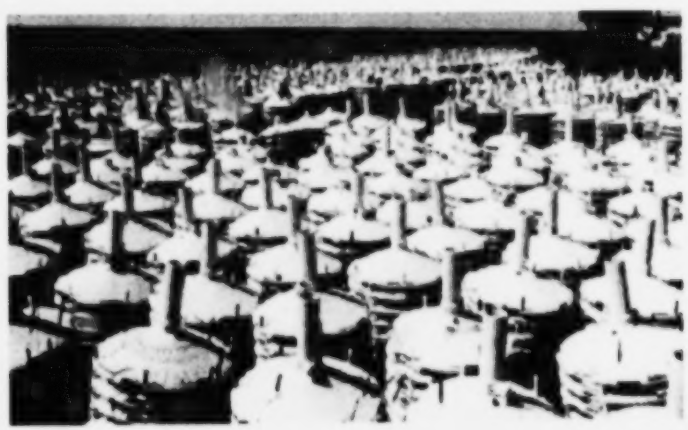
Tolerating a temperature range of -2°C to 32°C, the ideal ecological conditions for oyster culture are found only in the moderate depths of sheltered bays and estuaries where warm waters and firm and stable bottom texture are found. During the cold seasons, water depth is critical for oyster survival. In most places in the Gulf, oysters should be located at least 1 m below the low spring tides to be adequately protected from ice, and at lower depths in areas where thick, drifting ice packs are present during spring break-up.

Climate is a major constraint on oyster production in eastern Canada. It has variable effects that may take many forms, such as unreliable recruitment; short harvesting season; extensive maintenance of culture facilities in areas exposed to heavy winter ice; spring and fall storm damage; long period of growth from spat to market size; and slow turnover of capital invested in seed. These are all problems that can however be mitigated by careful selection of grow-out sites.

2.2.2 Spat and Seed Collection

Young oysters can be gathered from public beds to be relayed on private leases by the aquaculturists themselves (with a licence) or by purchasing the seeds from commercial fishers. Aquaculturists can also choose to collect their own spat from collectors on leases. Collectors are usually put in the water just before spatfall, around 3 weeks after the water warms above 20°C and spawning occurs. In the Gulf Region, collectors are usually put in the water in late July. Throughout the years, many different types of spat collectors have been used. These included Chinese hats, egg crate, vexar sheets, tiles, veneer rings, scallop shell.

Figure 5. Chinese Hat Collectors



Veneer rings coated with cement mixture and shell bags are often used by aquaculturists in PEI and "Chinese hats" (Figure 5) are often used in Eastern NB by growers that coat the collectors with a cement mixture. The spat are grown in suspension on these collectors until they reach the desired seed size (around mid-Fall).

The aquaculturist can leave the oysters to grow in suspension on their original collector until they reach market size (at least 76mm). However, only scallop shell collectors suspended in the water from floats, fences or longlines have been successful with this technique, and even then the very fast-growing

oysters had very thin shells that need hardening before facing shipping. Most aquaculturists will separate the seed from the collectors to grow them on the bottom (bottom culture) or on other types of support structures in the water column (off-bottom culture).

2.2.3 Bottom Culture

After having collected the oyster seed, they are carefully spread on the bottom. The spreading of seed may be done either from a boat, which often requires some redistribution, or directly on the ground at low tide. Optimum seeding density varies from one area to the other. Once the seeding is complete, the aquaculturist has to make regular visits to detect and control predation, monitor growth and survival, and check for vandalism and pilfering. To protect the oysters from predators, aquaculturists can place the oysters in a protective material, such as vexar mesh bags on bottom racks until they are big enough to resist starfish attack (40-50 mm). When the oysters finally reach market size, the grower harvest them using the same equipment as fishing for wild oysters (e.g. rakes and tongs).

2.2.4 Off-bottom Culture

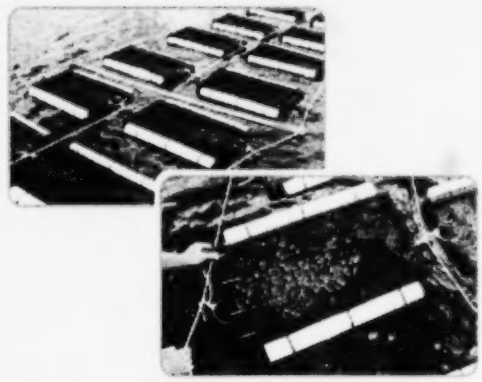
The off-bottom technique consists of growing oyster seeds in suspension until they reach the desired market size. There exist different suspended techniques, such as rafts (Figure 6), floating longlines, and fences. Oysters held in suspension usually grow faster and develop plumper meats than oysters grown on the bottom because better water circulation increases the availability of food. However, as a result of rapid growth, their shells tend to be thin. In order to produce shell qualities of the shape and thickness desired by consumers, oysters grown this way often need to be held for an additional year or two on the bottom or on suspended trays.

Figure 6. Oyster Rafts

Another method of suspension has been developed for cocktail oysters (less than 76 mm). The oysters are grown in floating bags close to the water's surface during the summer season (Figure 7). They hibernate in suspension under the ice in the fall, and are put back for growth at the water's surface the following spring where the oysters will benefit from optimum nutrition, oxygen and metabolic gas levels. Around 31 aquaculturists in Eastern New Brunswick

are growing cocktail oysters this way. They believe that the mixing of the oysters under the effect of the waves and the daily maintenance combined with a low rearing density, help to shape the oyster and thicken its shell, resulting in a clean oyster that is generally round or oblong with a high meat yield.

Figure 7. Floating Bags



Source: Maison Beausoleil - www.maisonbeausoleil.ca

Moreover, in the best conditions, the production period from seed to the cocktail-size oyster which is around 50 mm, is reduced to 3-4 years. Although this method of suspension is very promising and has been successful for certain producers in Eastern NB, it is worthwhile to note that the method has not acquired the same success everywhere in the Gulf Region. Research and development is continuing and still improving.

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Chapter 3 – Oyster Harvesting Management

3.1 Management Strategy

3.1.1 Wild Oyster Fishery

In the Gulf Region, multi-year Integrated Fisheries Management Plans in conjunction with annual harvesting plans are developed by DFO who is responsible for managing the wild oyster fishery. The Department develops these plans in consultation with its clients (commercial fishers, Provincial fisheries, members of the Aboriginal communities, producers, processors, etc.).

The commercial oyster fishery is in general manage based on effort controls such as limit of number of permanent licences, gear restrictions, shell-size limits, seasons with daily and weekly close times, and area closures. An example of gear restrictions is the dredge, which is only authorised on the Miramichi River and can not be more than 78.74 cm wide by 66.04 cm deep (31" x 26") measured on the outside. Moreover, only one dredge is allowed per licence.

Following key legislation for the management of the commercial oyster fishery:

- *Fisheries Act*
- *Fishery (General) Regulations*
- *Maritime Provinces Fishery Regulations*
- *Management of Contaminated Fisheries Regulations*
- *Aboriginal Communal Fishing Licences Regulations*

Fishing activities are controlled and monitored by the Conservation and Protection Branch who is responsible for patrolling areas where oysters are present.

3.1.2 Cultured Oysters

DFO is also the lead federal agency for aquaculture development and is committed to ensuring the responsible and sustainable development of the aquaculture industry in Canada. The Department is responsible to enforce regulations governing aquaculture activities, such as patrolling and controlling leased areas to ensure that the leases are properly marked and that oysters are grown and harvest with-in the defined area.

A policy respecting the harvest and marketing of cocktail oysters by licensed aquaculturists in Prince Edward Island, New Brunswick and Nova Scotia was developed by DFO in 1996 in consultation with the provinces involved. This policy is a result of requests from aquaculturists to be permitted to harvest and market undersized cocktail oysters (less than 76 mm) from oyster leases. DFO and the province of New Brunswick, conducted a pilot project that permitted the harvest and marketing of cocktail oysters from selected oyster leases under strict guidelines during 1993 and 1994. The policy, which is attached in Appendix 2, draws heavily on the experience gained in this pilot project.

The cocktail program applies to private leaseholders obtaining a *variation order* that will permit the harvesting and marketing of oysters of any size from a specific site during the periods specified in the order. The participants must sell their oysters through provincially and/or federally registered plants, which must submit to controls on the origin, quantity, and packaging of the product. Aquaculturists may join the program at any time, but once they are members they have to withdraw from all commercial oyster fisheries i.e. participants may not hold a commercial or contaminated oyster fishing licence. In 2001, there were 31 aquaculturists participating in the marketing program for cocktail oysters.

3.1.2 a) Aquaculture site administration

In Prince Edward Island, DFO is responsible for the administration of aquaculture leases since 1928 when an agreement was signed between the Dominion of Canada and PEI, which was reconfirmed between the Government of Canada and PEI in the 1987's Agreement for Commercial Aquaculture Development.

New Brunswick passed an aquaculture act in 1988 and signed a Memorandum of understanding (MOU) with DFO in 1989, which affirmed that the New Brunswick Department of Agriculture, Fisheries and Aquaculture (DAFA) is responsible for the administration of aquaculture licences and leases.

Nova Scotia was the first province to pass an aquaculture act, establish regulations, and appoint a provincial aquaculture coordinator. The Province also signed a MOU with DFO affirming that aquaculture licence and lease administration in Nova Scotia is the responsibility of the Nova Scotia Department of Agriculture and Fisheries (DAF).

3.2 Seasons

3.2.1 Fall Fishery

In the Gulf Region, the Fall oyster fishery and spat collection is conducted in uncontaminated public beds (approved areas) between mid-September to mid-December (specific date depending on location). During the harvesting open seasons, there are weekly close times from sunset to sunrise, Monday to

Saturday and all of Sunday.

Although very limited in the Gulf Region, there is a recreational fishery that is also a fall fishery. The recreational component in PEI is very small for reasons such as the licence freeze of 1987 and the licence condition of 1993 where recreational fishers had to fish by hand operated tongs from a vessel. In Eastern NB, there has been no authorised recreational fishery in the area since 1996. In Gulf NS, the season is open sometimes between September 22 to December 15 depending on location.

3.2.2 *Spring Fishery*

In the Gulf Region, commercial fishers can also harvest oysters in contaminated public beds (conditionally approved or closed areas) during the open season, which is between May 1 and July 31 (specific date depending on location). The oysters of at least 76 mm are sold to registered buyers who then relay (transfer) the oysters to approved beds or private leases in clean areas, or to a depuration facility for cleansing. Presently, a portion of the oysters in the Gulf Region are produced this way - around 33% of commercial licences are issued for relaying oysters. All activities related to the harvesting and transportation of bacteriologically contaminated stock destined for depuration and/or relaying are supervised, verified, and carried out under conditions detailed in a management plan or a Memorandum of Understanding (MOU). There are several benefits to this method: it allows for the utilization of an otherwise unavailable resource; it works over existing natural beds, usually of benefit to the substrate; it further distributes a local gene pool and may provide some natural spawning enhancement; and most significantly, there may be the depletion of natural stock from polluted areas, which reduces the incentive for illegal harvests that can pose a significant public health hazard.

3.2.3 *Cultured Oysters*

Leaseholders in PEI are allowed to harvest off their leases from August 1 to April 30. In NB and NS, there is no timeframe restriction but the higher level of output is achieved during the same period of time, from late summer to early winter. The highest monthly output is achieved in October and November although the marketing season is increasingly extending through the winter.

The shortage of natural seed stock can hamper on future growth and cause problems. For this reason, increasing number of aquaculturists are electing to collect their own seed and rear them to market size. The season for the spat collection is open from June 28 to December 31 in PEI and year-round in Eastern NB and Gulf NS, although collection usually occurs around mid-Fall. Specific allowed period of collection differing from one location to the other is indicated on the spat collection licence.

3.3 Licences

All individuals participating in the commercial oyster fisheries (fall and spring) in the Gulf Region must hold a licence. Oyster fishing in approved areas is a limited entry fishery[1] , i.e. no new licences are available; participants must be registered as commercial fishers and have held a licence in the previous year. In PEI and Gulf NS, only registered commercial fishers and in Eastern NB, only private leaseholders may obtain a spat collection licence.

The issuance of a contaminated shellfish fishing licence is dependent on an approved decontamination plan under the *Management of Contaminated Fisheries Regulations*.

[1]Limited entry applies in the Gulf Region, except in the Nova Scotia Administrative Area of the Gulf sector, where commercial oyster licences are available to persons who are resident of this Administrative Area and who hold a commercial licence for another species valid for the Gulf Nova Scotia waters, or for 1996 only, and to persons who held an oyster licence for this Administrative Area in either 1993 or 1994.

3.4 Leases

There are a number of leases that are granted to individuals or Company/Corporation. The lease agreement provides them of ownership of the fish species identified in the agreement within the lease boundaries and allows for the use of the sea-bed or water column to cultivate their species.

The application processes for PEI, NB, and NS (illustrated below) are similar, except that the lead agencies are different. The complexity of the application will determine the turnaround time to process it. Some applications will require a formal assessment under the *Navigable Waters Protection Act (NWPA)* and under the *Canadian Environmental Assessment Act (CEAA)*, which will require additional time for review.

Application Process for a New Marine Aquaculture Site

Step 1	■ The DFO Charlottetown Aquaculture Division in **PEI**, ■ the New Brunswick DAFA in **NB**, or ■ the Nova Scotia DAF in **NS**,	is responsible for helping the applicant complete and submit a **lease application package**, which includes an application fee, an application form, a site development plan, and a digital map showing the site location.
Step 2	■ The Leasing Referral Committee[2] in **PEI**, ■ the new Brunswick DAFA regional office in **NB**, or ■ the Technical/financial Committees[3] in **NS**.	will evaluate the applications, *review issues against current policy, coordinate the NWPA and CEAA review, coordinate public notifications and consultations, develop recommendations, and provide advice on the application.
Step 3	■ The Leasing referral Committee in **PEI**, ■ the Aquaculture Evaluation Committee in **NB**, or ■ the Nova Scotia Minister of Agriculture and Fisheries in **NS**	will make the decision to either support, d'support with conditions or reject the application and will communicate an explanation to the applicant.

*During the initial lease approval stage, federal authorities may be required to issue authorization for aquaculture activities related to the following:

- environmental assessments, under the *Canadian Environmental Assessment Act (CEAA)*,
- navigable water approvals, under section 5(1)of the *NWPA*, and
- the possibility of a harmful alteration, disruption or destruction (HADD) of fish habitat under section 35 of the *Fisheries Act*,

The federal government must also assess the impact of proposed aquaculture sites with respect to a number of other matters including, native rights and land claims, migratory birds, utilization by other groups, and shellfish food safety.

[2]The Leasing Referral Committee is composed of members from DFO: Conservation and Protection Branch; Habitat Branch (Canadian Environmental Assessment Act); Canadian Coast Guard - Navigable Waters Program; a secretary; and members from PEI Department of Fisheries, Aquaculture and Environment: Fisheries and Aquaculture Division; and Water Resources Division. The Chief, Aquaculture Division is also in attendance to provide information as required.

[3]The Technical/financial Committees are sub-committees of the Nova Scotia Aquaculture Development Committee (NSADC), which consists of members representing government departments and agencies who have regulatory, development, research and potential funding involvement regarding aquaculture. Members represented are: NS Dept. of Agriculture and Fisheries; Dept. of Fisheries and Oceans (including Canadian Coast Guard); National Research Council (IRAP); NS Dept. Economic Development and Tourism; Human Resource Development Canada; Federal Business Development; Bank Canada; ACOA; Sustainable Economic Development; Industry Canada; Environment Canada; Farm Credit Corporation; Aquaculture Association of NS; Enterprise Cape Breton; National Research Council (IMB).

3.4.1 NWPA Review

The approval process is intended to ensure that any interference created by the work in question is acceptable, and the rights of other users of the waterway are respected. Any works undertaken in a navigable waterway must receive Coast Guard approval prior to its construction. The type of approval required and the process to be followed will vary depending on the type and complexity of the proposed work. The formal approval process is followed when a Coast Guard Official determines that the work is considered to "substantially interfere with navigation", or the work is named in the Act. Most suspension-

type aquaculture operations, would appear to fall within this determination.

3.4.2 CEAA Review

Under the *CEAA*, environmental assessments are initiated when there is a "trigger " as a result of the federal government carrying out a project, providing financial assistance, issuing a permit or licence, providing land, etc. The department whose action results in triggering the environmental assessment (EA) is responsible for managing the environmental review process. An example of a CEAA trigger is the issuance of an approval under section 5(1) of the *NWPA*.

The type of EA required will vary with the complexity of project, as well as with its possible environmental effects. The vast majority of marine aquaculture projects require an EA and are assessed relatively quickly by undergoing what is known as a screening type of assessment. A screening is a systematic approach to documenting the environmental effects of a proposed project by determining the need to modify the project plan or by recommending further assessment, through mediation or a panel review, to minimize or mitigate these effects. A comprehensive study or review by an independent EA review panel or mediator will be required:

- for projects of large-scale, complex, and environmentally sensitive,
- if it is uncertain that a project is likely to cause significant adverse environmental effects, or
- if public concern warrants (the public is involve so their concerns are taken into consideration during the decision-making process).

Upon completion of the assessment and review, the responsible authority must determine whether the project is likely to cause significant adverse environmental effects, after taking into consideration the implementation of mitigation measures. That determination will dictate whether DFO can provide the NWPA approval and/or the *Fisheries Act* authorization.

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Chapter 4 – Statistics

4.1 Wild Oyster Fishery

Most commercial and communal oyster licences (75%) in the Gulf Region are issued for fishing in approved areas (clean waters). Table 1 shows the breakdown of licences in the Gulf Region by area and by type of licence. Around 52% of commercial oyster licences are issued in PEI, 43% in Eastern NB, and 5% in Gulf NS. The majority (88%) of fishers holding a Spring commercial licence, also hold a Fall commercial licence. In addition there are also oyster spat collection licences issued for approved and closed areas, as well a few communal commercial oyster licences that are issued to First Nations/Council (76% in PEI, 15% in Eastern NB, and 9% in Gulf NS).

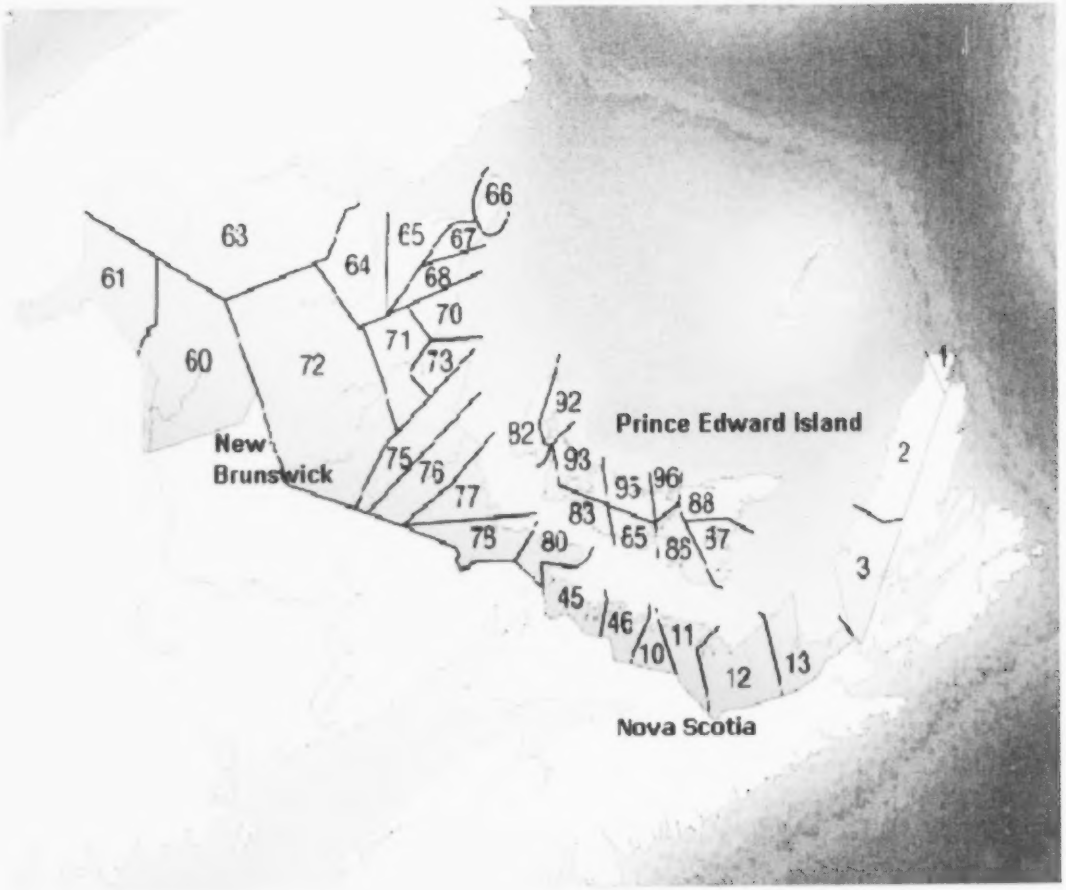
Table 1. Oyster Licences Issued by Area, Gulf Region - 2002

Type of Oyster licence		PEI	Eastern NB	Gulf NS	TOTAL GULF
Commercial Fishery	FALL (in uncontaminated areas)	978	1,501	191	2,670
	SPRING Relay (in contaminated areas)	863	0	0	863

Total – Commercial		**1,841**	**1,501**	**191**	**3,533**
Spat collection	In Uncontaminated areas	109	19	1	129
	In Contaminated areas	80	4	0	84
Total – Spat collection		**189**	**23**	**1**	**213**
Aboriginal Communal Commercial Fishery	FALL (In Uncontaminated areas)	54	17	11	82
	Spring Relay (In Contaminated areas)	34	0	0	34
Total - Aboriginal Communal Commercial		**88**	**17**	**11**	**116**
Recreational Fishery		**29**	**0**	**38**	**67**
TOTAL		**2,147**	**1,541**	**241**	**3,929**

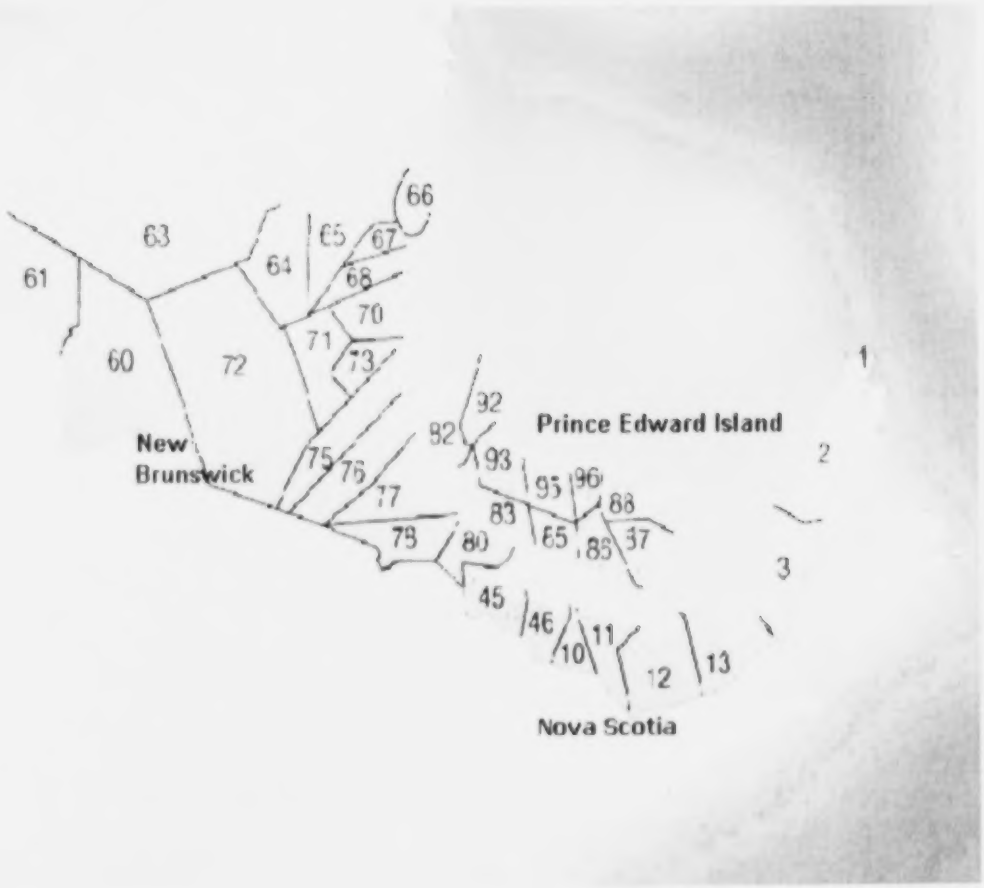
Figure 8 illustrates the distribution of commercial oyster fishing licences in the Gulf Region by statistical district. (Geographical boundaries of all districts are described in Appendix 1).

Figure 8. Statistical Districts



Fall and Spring Licences

PEI			ENB		GNS	
Dist.	**Fall Licences**	**Spring Licences**	**Dist.**	**Fall Licences**	**Dist.**	**Fall Licences**
82	116	94	**63**	1	**45**	47
83	334	389	**64**	4	**46**	55
85	48	25	**65**	172	**10**	16
	61	58		260		48



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85	48	25	**65**	172	**10**	16
	61	58		260		48

86			**66**		**11**	
87	17	2	**67**	107	**12**	14
88	48	16	**68**	41	**13**	7
96	141	6	**70**	236	**3**	1
95	22	15	**71**	16	**2**	2
93	129	130	**73**	369	**1**	1
92	189	128	**75**	126		
			76	41		
			77	69		
			78	12		
			80	47		

4.2 Leases and Growers

4.2.1 Distribution of Leases

There are a number of privately held oyster leases in the Gulf Region averaging in sizes between 0.4 - 40 hectares (1-100 acres). Fourty-seven percent of the Gulf Region's total leased areas are located in PEI, 44% in Eastern NB, and 15% in Gulf NS. Table 2 shows the breakdown of oyster sites by area.

Table 2. Oyster Sites Issued by Area, Gulf Region – 2002[1]

AREA	SITES		Average Hectares per Site
	Number	Hectares[2]	
Prince Edward Island	776	2,721	3.51
Eastern New Brunswick	624	2,513	4.03
Gulf Nova Scotia	33	518	15.71
TOTAL	**1,433**	**5,752**	**4.01**

Notes:

(1) Data for Eastern NB is from August 2001.

(2) One hectare is equal to 2.47 acre.

In PEI, the areas with the greatest concentration of oyster leases are Foxley Bay and Conway Narrows on the north shore, and Egmont Bay, Hillsborough River (East) and Orwell Bay on the south shore (Figure 9). The majority of oyster leases in PEI are bottom leases (84%) the remaining 16% being water column leases, which are off-bottom leases.

In Eastern NB, the American oyster is the primary specie cultured on leases concentrated along the coast of the Acadian Peninsula, between Caraquet and Tracadie, and in the Northumberland Strait by Richibouctou and Bouctouche (Figure 10). The other leases are found in the Miramichi Bay, mainly located along by the village of Neguac and in the Baie Sainte-Anne area.

As table 2 shows, Gulf Nova Scotia has significantly less oyster sites than PEI and New Brunswick. Most sites issued are located in Tatamagouche Bay and in Little Harbour. The leases in these two areas alone cover 373 hectares (921 acres) and 185 hectares (185 acres), which represent 86% of Gulf NS's total leased areas (Figure 11).

Figure 9 – Oyster Leases in Prince Edward Island

Click on the map for a full size version

Figure 10. Oyster Leases in Eastern New Brunswick

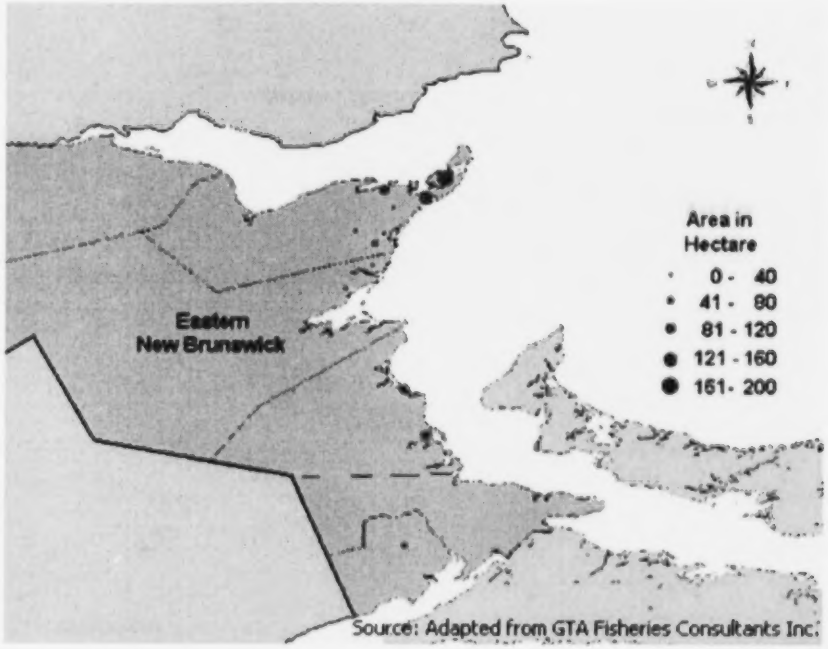
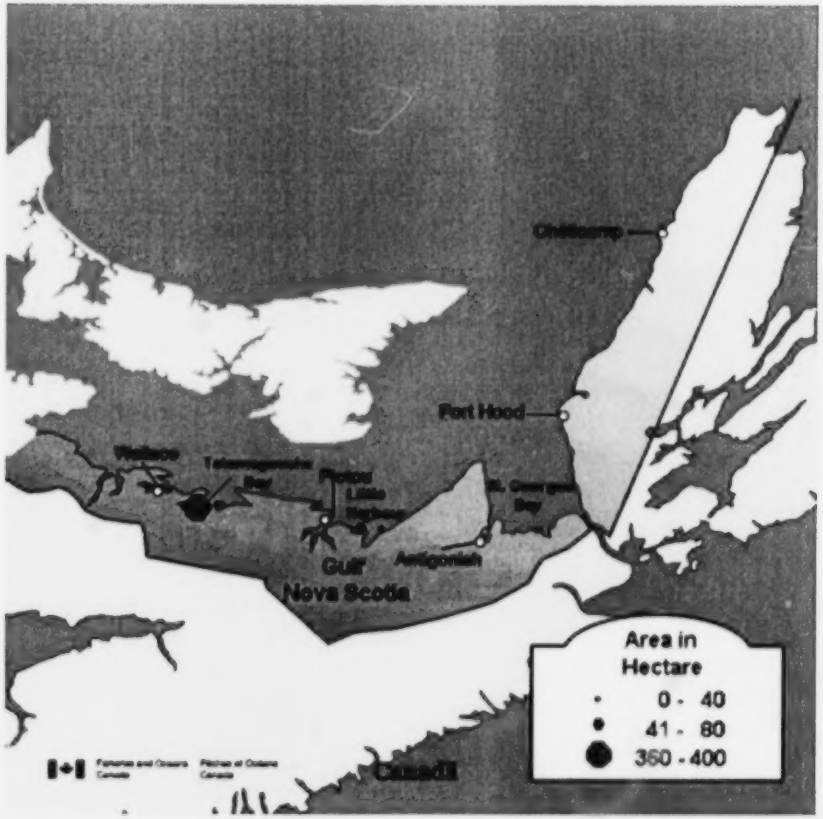


Figure 11. Oyster Leases in Gulf Nova Scotia



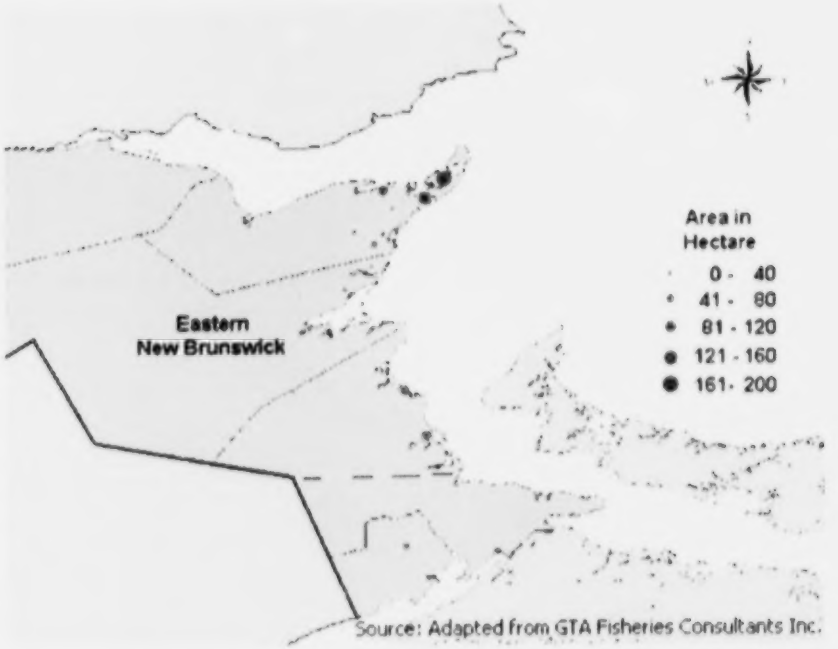
4.2.2 Growers

In PEI, the 777 leases are being held by 616 leaseholders (individuals or companies) of which, approximately 350 are also registered commercial fishers. It is estimated that the aquaculturists growing oysters from spat to adult in PEI employ around 50 people on their aquaculture operations.

In Eastern NB, it is estimated that there are 39 oyster growers. Thirty of them were interviewed for a recent study that found that in 2001, 127 people (including owners) were employed directly on aquaculture operations. (It is worth noting that many growers produce both oyster and mussels and employ the same personnel). Most oyster aquaculture operations are small with around 36% employing one to four employees during the course of the year and an additional 28% operating alone. One reason for this is that 46% of these oyster aquaculture operations have operated for less than 5 years.

In Gulf NS, the oyster leases are being held by 22 individuals and five companies. It is estimated that in 2001, there were 64 people working on oyster aquaculture operations in Gulf NS, of which 10 were employed full-time and 54 part-time.

4.3 Oyster Landings/Production



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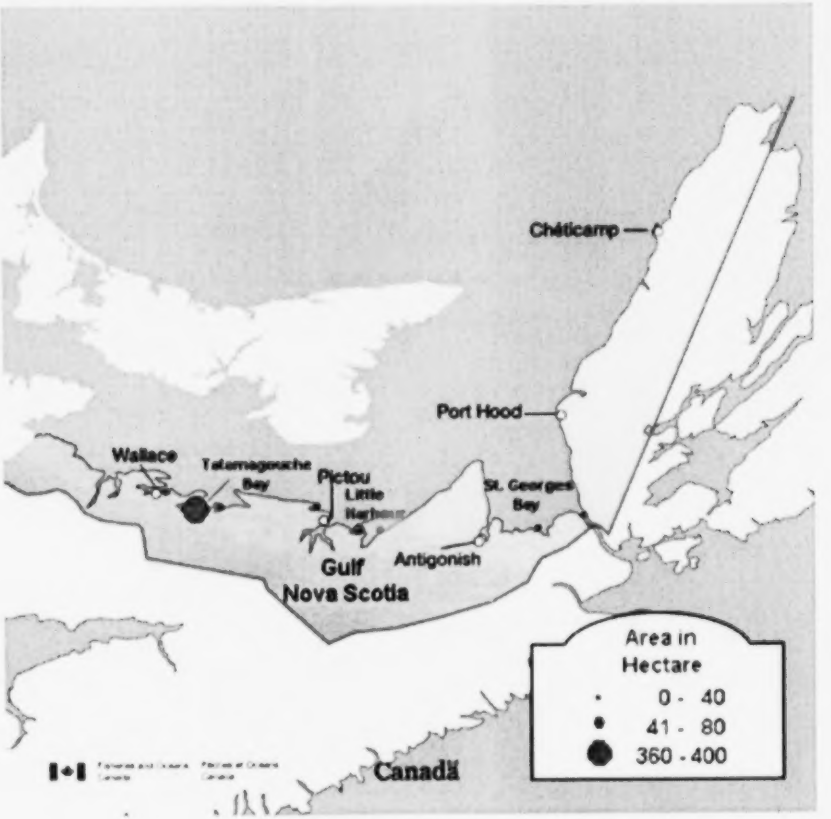

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4.3 Oyster Landings/Production

Statistics Canada (through annual surveys), reports on aquaculture statistics[4] on a provincial basis, but these include all oysters from leases i.e oysters grown from spat to adult, as well as contaminated oysters relayed from public beds to leases for depuration.

The oyster landings in this document was provided by DFO, Gulf Region's Statistics Division, which record landings received from purchase slips from provincially and/or federally registered buyers. At this time, landings from both public beds and private leases are compiled together, although effort is being made to report separately aquaculture and wild landings. However, it is estimated that the percentage of oysters produced (from spat to adult) by growers in 2001 compared to total oysters landed in each area was around 15-20% in PEI and 45% in Eastern NB. In Gulf NS, it is estimated that 65% of oysters landed have spent some period of time on leases.

[4]These statistics are posted on DFO's Web site on their Statistical Services Web Page, URL: http://www.dfo-mpo.gc.ca/communic/statistics/main_e.htm under "Aquaculture".

4.3.1 1991 versus 2001

Although oyster landings and values fluctuated year to year, overall, the Gulf Region's oyster landings have increased 55% in volume and 130% in value in the last decade (Table 3). The Region's overall growth is mostly due to PEI's important increase - 115% in volume and 245% in value. PEI's share of Gulf Region's total landings also increased significantly between 1991 and 2001 (24%), while Eastern NB's share decreased 25% and Gulf NS's share increased 1%.

Table 3. Oyster Landings, Values and Distribution (%) by Area, Gulf Region - 1991 versus 2001

Area	Landings (metric tons)		Distribution (%)	
	1991	2001	1991	2001
Prince Edward Island	1,182	2,537	62 %	86 %
Eastern New Brunswick	685	315	36 %	11 %
Gulf Nova Scotia	32	97	2 %	3 %
GULF	**1,899**	**2,949**	**100 %**	**100 %**
Area	**Value (thousands of dollars)**		**Distribution (%)**	
	1991	**2001**	**1991**	**2001**
Prince Edward Island	1,832	6,325	55 %	83 %
Eastern New Brunswick	1,426	996	43 %	13 %
Gulf Nova Scotia	57	287	2 %	4 %
GULF	**3,315**	**7,608**	**100 %**	**100 %**

4.3.2 1997 to 2001

Oyster landings and values in the Gulf Region have fluctuated during the last five years. As shown in Table 4, PEI's landings are much higher, accounting each year for at least 75% of Gulf Region's total oyster landings and values. As a whole, the Gulf Region's landed value increased 88% from 1997 to 2001.

Table 4. Oyster Landings and Values by Area, Gulf Region - 1997 to 2001

Area	Landings in Metric Tons				
	1997	1998	1999	2000	2001
Prince Edward Island	1,293	2,417	3,353	3,650	2,537
Eastern New Brunswick	351	506	315	248	315
Gulf Nova Scotia	82	221	335	236	97
GULF REGION	**1,726**	**3,144**	**4,003**	**4,134**	**2,949**
Area	**Value in Thoudands of Dollars - $000**				
	1997	**1998**	**1999**	**2000**	**2001**
Prince Edward Island	3,093	5,251	7,159	8,815	6,325
Eastern New Brunswick	783	1,348	1,027	782	996
Gulf Nova Scotia	173	453	824	610	287
GULF REGION	**4,049**	**7,052**	**9,010**	**10,207**	**7,608**

4.4 Product

The legal market length of an oyster is 76 mm in shell length, except for the cocktail oyster which has no size-limit, but can only be produced by aquaculturists participating in the cocktail oyster program. Even though the cocktail oyster is smaller in shell-size, aquaculturists have been able to obtain a comparable meat ratio than the market oyster.

According to Canadian fish inspection regulations, American oysters must be bought and sold according to four grades based on shell shape: "fancy", "choice", "standard" or "commercial". The three first grades consist of oysters that have a length that is respectively no more than 1.5 times, 1.75 times and 2.0 times its greatest width and can not be abnormally flat, thin-lipped, or malformed. All oysters that do not meet these requirements are graded as "commercial". In 1972, the percentages of oysters sold (in the Maritimes) in each grade were about 38% "choice", 43% "standard" and 19% "commercial" compared to 65% "choice", 25% "standard" and 10% "commercial" in the 1990s when the grade and quality improved because of government and industry working as partners for the cultivation of beds. "Fancy" oysters were too rare to be statistically relevant.

Although the Gulf Region's oyster production is modest on a global scale, it is considered on many markets of high quality. Providing the temperature is maintained just above freezing and the atmosphere is damp, oysters are capable of living out of water for about four months. The majority of the oysters that are harvested for commercial purposes are sold to provincially and federally registered buyers with some fishers selling oysters directly to the public. For the most part, oysters are sold fresh in the shell. Only a small part of the market is for shucked oyster packed in small containers in their own juice. Oysters are usually packed in large wooden or cardboard, varying from 1.5 to 5.5-peck boxes, which prices depend on the grades and locations.

Between 1997 and 2001, the average price of oysters paid by registered provincial and/or federal buyers in the Gulf Region fluctuated from a low of $2.24/kg in 1998 to a high of $2.58/kg ($1.17/lb) in 2001.

4.5 Domestic Markets

The Gulf Region has a well-established oyster market and one of the oldest in Canada. It has been selling the bulk of its oyster production domestically, principally in Montreal and Quebec City. Some oysters are also sold in the Toronto and Ottawa Region, but few are shipped out west where another type of oyster (Pacific oyster) is found. In the last five years however there has been a shift towards exports.

In general, the *fancy* and *choice* grades go mainly to upscale restaurants, the *standards* to hotels, restaurants and grocery stores, and the *commercials* to groups having annual outings or organization-sponsored "oyster parties". The cocktail oyster market is concentrated in Montreal and Toronto, where oysters are sold to restaurants. However, promotions to develop more markets in the United States is presently being done.

4.6 Export Markets[5]

The following market analysis will expand beyond the Gulf Region, focusing on the three Maritime Provinces because data on exports are only available on a provincial basis. Also, it is important to note that oysters exported from one province to another country do not necessarily mean that these oysters were harvested or processed in that province.

[5]Only domestic exports are included, which consist of the "exports of all goods grown, produced, extracted or manufactured in the country, leaving the country for a foreign destination. Exports of imported merchandise which has been substantially enhanced in value are also included". Source: Statistics Canada. Strategis: www.strategis.gc.ca.

4.6.1 Major Canadian Exporters

In the last few years, increasingly more oysters are being exported, principally to the United States (U.S.). The two major Canadian exporters are British Columbia, which export mainly Pacific oysters, and PEI. In 2001 they exported over $9 Million worth of oysters, representing 89% of Canada's total (Table 5). Nova Scotia is the third biggest exporter, contributing 10.5% of Canadian's exports.

Table 5. Oyster Export Values, Distribution by Province, Canada - 1997 -2001

Province	1997	1998	1999	2000	2001
British Columbia	72.3 %	54.5 %	53.0 %	40.7 %	47.3 %
Prince Edward Island	24.5 %	35.7 %	37.6 %	48.9 %	41.7 %
Nova Scotia	2.7 %	8.0 %	9.0 %	10.1 %	10.5 %
New Brunswick	0.2 %	1.6 %	0.2 %	0.3 %	0.2 %
Saskatchewan	-	-	-	-	0.3 %
Quebec	0.2 %	-	0.1 %	-	-
Ontario	0.1 %	0.1 %	-	-	-
Alberta	-	-	-	0.03 %	-
Others	-	-	-	-	-
TOTAL CANADA	**100 %**	**100 %**	**100 %**	**100 %**	**100 %**

Although 2001's export values were down from 2000 in all three Maritime Provinces, as a whole, the Maritimes showed a significant increase from 1997 (Table 6). In fact, 2001's value was more than three time that of 1997, mostly due to PEI and NS, which increased a remarkable 204% and 597%

respectively for the same period.

Table 6. Oyster Export Values ($000) by Province, Canada - 1997 to 2001

Province	1997	1998	1999	2000	2001	Rank in 2001
Prince Edward Island	1,419	2,034	3,225	5,739	4,306	2
New Brunswick	13	93	19	34	23	5
Nova Scotia	156	454	776	1,180	1,087	3
Newfoundland	-	-	-	-	-	
Total Atlantic Canada	**1,588**	**2,581**	**4,020**	**6,953**	**5,416**	**-**
Quebec	14	-	7	-	-	-
Ontario	4	7	-	-	-	-
Saskatchewan	-	-	-	-	27	4
Alberta	-	-	-	4	-	-
British Columbia	4,191	3,103	4,550	4,776	4,895	1
Manitoba & Territories	-	-	-	-	-	-
TOTAL CANADA	**5,797**	**5,691**	**8,577**	**11,733**	**10,338**	**-**

Prince Edward Island is by far the biggest oyster exporter of the Maritime Provinces, contributing, in average, 82% of total exports in the last five years. Table 7 illustrates how export values are distributed among the three Maritime provinces.

Table 7. Oyster Export Values, Distribution by Province, Maritime Provinces - 1997 to 2001

Province	1997	1998	1999	2000	2001
Prince Edward Island	89.4%	78.8%	80.2%	82.5%	79.5%
New Brunswick	0.8%	3.6%	0.5%	0.5%	0.4%
Nova Scotia	9.8%	17.6%	19.3%	17.0%	20.1%
TOTAL	100%	100%	100%	100%	100%

4.6.2 International Destinations

Table 8 shows the value of oyster exports by destination between 1997 and 2001 in PEI, NB and NS. The U.S. receives most oysters exported by these three provinces. In 2001, 96% of oyster exports from the Maritime provinces were transported to the U.S.

Table 8. Oyster Export Values ($000) by Province and by Destribution, Maritimes Provinces - 1997 to 2001

Destination	1997	1998	1999	2000	2001

United States	1,419	2,034	3,225	5,739	4,306
Total PEI	**1,419**	**2,034**	**3,225**	**5,739**	**4,306**
United States	13	93	19	34	23
Total NB	**13**	**93**	**19**	**34**	**23**
United States	145	270	668	1,130	853
Belgium	11	45	13	18	-
United Kingdom	-	128	-	-	-
St.Pierre-Miquelon	-	12	19	-	-
Hong Kong	-	-	59	-	-
France (include Monaco & Andorra)	-	-	16	-	192
Singapore	-	-	-	21	
Iceland	-	-	-	11	12
Cuba	-	-	-	-	30
Total NS.	**156**	**455**	**775**	**1,180**	**1,087**
United States	**1,577**	**2,397**	**3,912**	**6,903**	**5,182**
Belgium	**11**	**45**	**13**	**18**	-
United Kingdom	-	**128**	-	-	-
Others	-	**12**	**94**	**32**	**234**
TOTAL MARITIMES	**1,588**	**2,582**	**4,019**	**6,953**	**5,416**

Appendix 3 illustrates the history of oyster exports (1991 to 2001) in the Maritime Provinces by destination and by provinces. Since 1996, all of PEI's oyster exports have been going to the U.S., and between 1991 and 1995, less than 5% of PEI's total was distributed to Luxembourg, Belgium, St. Pierre-Miquelon, and/or Germany.

Since 1991, all of NB's oyster exports also have been going to the U.S. except in 1994 when 1.1% was exported to Hong Kong.

As for NS, its market is more diversified although between 1991 and 2001, 59% to 100% of NS's oyster exports also went to the U.S. Other international destinations included St.Pierre-Miquelon, Western Europe, Hong Kong, Singapore, and Iceland.

4.6.3 United States Destinations

For the past five years, the Maritime Provinces' exports have been going in majority to three U.S. destinations, which are Massachusetts, Maine and California (Table 9). In 2001 however, exports to Texas were slightly higher than to California.

Table 9. Oyster Export Values ($000) by Province and by Main U.S. Destination, Maritime Provinces - 1997 to 2001

Destination	1997	1998	1999	2000	2001

Massachusetts	445	782	1,416	2,424	1,749
Maine	693	1,030	1,271	1,522	1,080
California	228	140	301	686	419
Texas	-	16	5	227	493
Others	53	65	234	880	566
Total PEI	**1,419**	**2,033**	**3,227**	**5,739**	**4,307**
Maine	13	90	19	11	4
District of Columbia	-	2	-	16	-
Massachusetts	-	-	-	7	8
Rhode Island	-	-	-	-	10
Total NB	**13**	**92**	**19**	**34**	**22**
Massachusetts	6	19	119	499	345
Rhode Island	5	149	357	387	277
Maine	104	71	104	132	129
California	15	14	74	56	17
Hawaii	14	-	-	4	-
Others	-	17	14	51	86
Total NS	**144**	**270**	**668**	**1,129**	**854**
Massachusetts	451	801	1,535	2,930	2,102
Maine	810	1,191	1,394	1,665	1,213
California	243	154	375	742	436
Texas	-	16	5	227	493
District of Columbia	-	2	-	16	-
Rhode Island	5	149	357	387	287
Hawaii	14	-	-	4	-
Others	53	82	248	931	652
TOTAL, MARITIMES PROVINCES	**1,576**	**2,395**	**3,914**	**6,902**	**5,183**

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Chapter 5 – Research, Technology and Education

Following is a list of some of the research projects, programs and facilities that contribute to the development of bivalve molluscs in the Gulf Region.

5.1 Department of Fisheries and Oceans

5.1.1 Oyster Monitoring Network

The *Oyster Monitoring Network* is a project that originated in 1996. The main objective of the project is to monitor natural growth rates and physiologica condition of bivalves in the southern Gulf of St. Lawrence. The approach is based on a standardised deployment and monitoring of *Crassostrea virginica* ir the most important culture bays. Results allow producers to compare the year-to-year performance of their own operation with the natural growth conditions They also allow biologists to verify whether geographical and temporal patterns in growth are correlated with the environment (e.g. temperature) o husbandry practices (e.g. stocking density). It is hoped that the continuation of this program will develop into an industry-government partnership.

5.1.2 Shellfish Health Unit

One of only two laboratories in Canada which specialize in shellfish health is located within the Gulf Region in Moncton, New Brunswick. The *Shellfish Health Unit* examines all species of bivalve molluscs for parasites, pests and diseases. This enables them to compile health profiles for both normal anc unhealthy molluscs. This information acts as a reference base for determining the best approaches to avoid the introduction and spread of disease, as wel as manage diseases that are already present.

Recent work has concentrated on soft-shelled clams, hard-shelled clams (quahaugs) and bar clams, however, the shellfish health team still spend much o their time on species which are harvested commercially or cultured traditionally such as oysters and mussels.

In addition to keeping an eye on the health of Atlantic bivalve molluscs, the *Shellfish Health Unit* is also frequently called upon to give health advice anc training to developing shellfish industries elsewhere in the world. In recent years, the shellfish pathology research scientist from *Shellfish Health Unit* has been involved with the Food and Agricultural Organization (FAO) of the United Nations in the development of guidelines and operating procedures tc minimize the risks of disease with transfers of live aquatic animals throughout the Asia-Pacific region. In addition, this scientist has been invited tc investigate mass mortalities of pearl oysters in Japan and the Philippines. All this experience has been valuable for managing disease problems anc advising on the development of *National Aquatic Animal Health* programs for Canada.

5.1.3 Validating Fish & Shellfish Health Tests

Effective regulations that allow DFO to monitor the health of fish and shellfish are in place in Canada. The tests currently available to identify and detec disease agents are constantly changing as new techniques are developed. The advantage of newer methods (using biomolecular techniques) is that they are more sensitive and more specific than traditional tests. However, the new tests need to be validated to determine how specific and how sensitive they are.

When laboratories diagnose human and animal disease agents, they use standard methods. DFO's scientists are working with other agencies to establish similar guidelines for the testing of fish and shellfish disease agents. In collaboration with the Atlantic Veterinary College, the Research and Productivity Council and others, scientists are drafting protocols so that a consistent testing procedure will exist for all laboratories. Once these standards are in place these new tests will provide accurate tools to detect and identify pathogens in fish and shellfish.

5.1.4 Aquaculture Collaborative Research and Development Program(ACRDP)

The *ACRDP* is a DFO initiative to increase the level of collaborative research and development activity between the aquaculture industry and the departmen and in some instances with other key funding partners. *ACRDP* is an industry-driven program that will pair industry with DFO researchers. Projects are conducted at DFO Research facilities or possibly industry partner facilities.

The key goals of the program are to

- improve the competitiveness of the Canadian aquaculture industry,
- increase collaboration between the department and industry on scientific research and development that will enhance aquaculture in Canada,
- facilitate and accelerate the process of technology transfer and research commercialisation through closer collaboration with the Canadian aquaculture industry, and
- increase scientific capacity for essential aquaculture research and development in the aquaculture sector.

DFO approved under the first two rounds of the ACRDP for the 2002-2003 fiscal year, $7.5 million worth of projects. The industry's financial contribution for the projects is 25% of the total cost to conduct the research. The variety of approved projects demonstrates a balance in addressing the three key industry priorities: aquaculture production, fish health and environmental issues. The projects focus on marine salmonids and finfish, as well as molluscs and other species, and some projects are also conducted in fresh water aquaculture. These projects will contribute significantly to the research necessary for Canada's aquaculture industry to increase its competitiveness in international markets.

Regionally, the following project relating to oysters has been approved:

Title: *Predator and competitor interaction with bivalve culture: development of an effective management approach.*

Description: The impact of predators, such as sea stars and crabs, and competitors, such as tunicates, on bivalve farming (oysters and mussels) is significant. The presence of both predators and competitors can result in decreased growth and survival. This project is designed to examine the life cycle of key predators and competitors. It will also develop management strategies that farmers can use to reduce the impact of these predators and competitors.

Industry Collaborators: PEI Aquaculture Alliance.

Project Duration & ACRDP Funding: 4 years; $234,200

5.2 Provincial Departments of Fisheries

5.2.1 PEI Department of Fisheries, Aquaculture and Environment

The Aquaculture Section of the PEI Department of Fisheries, Aquaculture and Environment delivers programs to assist in the development of the aquaculture industry such as the *Aquaculture Technology Program*, and the *Aquaculture Diversification Program*. These Programs provides technical service to producers and processors and are incentives for aquaculture operators to adopt new techniques or technologies, to assess new approved species, and to stimulate diversification within the aquaculture sector.

5.2.2 NB Department of Agriculture, Fisheries and Aquaculture (DAFA)

The DAFA has a team of professionals assigned to aquaculture development and to biology technology transfer research. The majority of the staff, working from the Aquarium and Marine Centre, offers the industry a range of services and does research and development work on fish and mollusc farming in the natural environment, as well as in the wet or dry high-tech laboratories. In addition, a bivalve shellfish hatchery makes it possible to breed shellfish under artificial conditions. This tool is used to develop shellfish rearing techniques designed to maximize production of spat in hatcheries, and later, of fry in the natural environment.

Disease diagnosis, spatfall prediction, and site evaluation are among the many services offered to the aquaculture industry by the Fisheries and Aquaculture staff working at the Aquarium. The objective of these activities is to optimize the performance of New Brunswick's aquaculture industry in order to make it more competitive on national and international markets.

5.2.3 NS Department of Agriculture and Fisheries (DAF)

5.2.3 a) Technology Development Programs

The Nova Scotia DAF offers several Technology Development Programs such as the Technology Transfer Program, Harvesting Technology, Studen Initiative, and Aquaculture Development aiming at developing and optimizing the harvesting, processing and recreational sectors of the Nova Scotia fishing and aquaculture industries. This is done through public-private partnerships, technology transfer, applied research and community development programs For example, the technology group of the Aquaculture Development works closely with the aquaculture industry on technical development projects conducted jointly by industry and the department. These projects enable participating mollusc and finfish growers to safely market their products.

5.2.3 b) Fisheries and Aquaculture Services

The Fisheries and Aquaculture Services has for mission *"to service, develop and manage the harvesting processing, recreational and aquaculture segments of the Nova Scotia fishing industry for the betterment of our coastal communities and the province overall."* It conducts a 40-week Aquaculture Mentorship program using Nova Scotia Agricultural College (NSAC) campus in Pictou and using established aquaculture farms in areas throughout the province. Clients spend a total of 10 weeks in the classroom in Pictou, where trained instructors and featured guest speakers offer information ranging from safety procedures, veterinary skills to entrepreneurship, record keeping and managing a small business. Then, they spend the remaining 30 weeks on location with their mentors working on the farm, learning first hand the techniques, schedules, procedures, problems and solutions aquaculturists encounter every day.

5.3 Academia and Research Facilities in the Gulf Region

5.3.1 Canadian Aquaculture Institute

Locally and around the world, the Canadian Aquaculture Institute (CAI) in PEI delivers professional training to the aquaculture industry. The CAI *Training Programs* have offered short courses, seminars and workshops to clients in a variety of aquaculture-related issues such as operational set-up and management, aquatic animal husbandry and nutrition, disease diagnosis and treatment for shellfish and finfish, and selective breeding programs. Courses may include classroom and laboratory components as well as field visits to various facilities. The training is delivered by industry professionals and exper researchers from the Atlantic Veterinary College, the University of PEI and other academic institutions.

5.3.2 Atlantic Veterinary College Inc. (AVC) Inc.

The University of Prince Edward Island (UPEI) houses a major player in aquaculture, the private for-profit company AVC Inc. The corporate arm of the UPE currently has divisions such as the *Atlantic Fish Health*, *Canadian Aquaculture Institute*, and *Cardigan Water Science Center* involved with Aquaculture Research.

The AVC facility is equipped with the most current equipment available for veterinary studies. There are also other corporate facilities, which manufacture some of the most widely used vaccination and medications for the fishing industry. These companies have built a reputation based on continuing outstanding results. AVC Inc. also provides consulting services to clients both within the University and externally. These services are very broad in scope and include business services such as contract negotiation and management; scientific analysis of specific problems principally in the areas of aquaculture fish health, and the environment.

5.3.3 Université de Moncton

The university has three campuses in New Brunswick: Moncton, Shippagan and Edmundston. It offers a Baccalaureate in Sciences (B.Sc.) with specialisation in biology either through the regular program or the coop program, or with major or minor in biology. The biology program offers basic theoretical and practical training in sciences biology that can eventually enable students to orient themselves in more specialised disciplines such as marine biology, aquatic ecology, and aquatic animal physiology. The goal of the coop program is to place the student in a work environment during his or her

studies. A master's degree in science (M.Sc.) in biology is also offered and aimed at giving extensive training to the student on a particular aspect o sciences biology.

The members of the biology faculty are actively doing research on aquatic ecology or are applying the results of fundamental research done in different fiek such as aquaculture of marine invertebrates. The university also hosts several Research Bureaux and Research Centers throughout the Province. Twc research centers involved in marine products and aquaculture are described below.

5.3.3 a) The Marine Products Research and Development Center Inc. (MPRDC)

The MPRDC, located in Shippagan (NB), is a non-profit organization incorporated in October 1990. Its mission is to provide assistance to the provincia fishery and aquaculture industry in its efforts to diversify existing marine products and commercialise new products from under-utilized and unexploitec species living in the Gulf of St. Lawrence.

The MPRDC's mandate is to assist the fisheries and aquaculture industry, mostly in New Brunswick, in its efforts to maintain and improve the quality of its marine products and its efforts to diversify these products. This mandate is realised through technical and scientific assistance in applied research, whict helps the development of new products, the transfer of new procedures and/or new technologies. Services such as chemical, microbiological and nutritiona analyses are also provided.

5.3.3 b) Centre de recherche sur les aliments (CRA)

The CRA is devoted to food research and to the delivery of services in the Atlantic food industry, particularly in the New Brunswick's industry. Its goal is tc assist the processors in apply research, development of new products, as well as chemical, microbiological and sensorial analysis. The CRA offers services in the agri-food and marine products and wants to direct its services towards small and medium enterprises to complement their resources and catalyse or technological innovation.

5.3.4 New Brunswick School of Fisheries

The New Brunswick School of Fisheries was founded in 1959 and its mission reads as follows: *"to ensure training to the fishery and aquaculture industries ir New Brunswick and be focused on the industries' needs so that they are economically viable"*. Located in Caraquet, the School offers training programs tc those persons wanting to obtain a diploma in order to practice or continue practising the profession of fishermen and aquaculturist among others. The School has developed teaching tools to provide necessary training in productivity, efficiency, responsibility and safety so as to meet the growing requirements of the fishery sector.

5.3.5 Mount Allison University

The biology curriculum at Mount Allison University, located in Sackville, New Brunswick, enables the student to develop a Major or a minor in Biology. Ir addition, the Biology Department also offers Honours B.Sc. and M.Sc. programmes. In the Biology Department, an attempt is made to give all students ar understanding of the basic scope, techniques and general principles which underlie biological science, to encourage independent study and self-learning and to provide opportunities to explore areas of advanced study in such areas as Ecology (freshwater, marine, terrestrial) and Physiology (animals, plants micro-organisms).

5.3.5 a) Coastal Wetland Institute

Research in the Coastal Wetland Institute is currently concerned with: ecology, evolution and systematics of aquatic organisms; environmental acclimation ir aquatic microorganisms, marsh plants, and algae; comparative physiology of fishes and invertebrates; geomorphology and evolution of marine coastlines environmental chemistry; and wetlands human ecology and management.

5.3.6 St. Francis Xavier University

St. Francis Xavier University (StFX), located in Antigonish, NS, offers a B.Sc. with Major in aquatic resources and in biology, a B.Sc. with Advanced Major in biology, a B.Sc. with Honours in biology, and a M.Sc. (biology). The Department of Biology offers courses intended for the preparation of students interested in advanced work in biology, courses which satisfy the requirements of students in professional and pre-professional programs, and courses of general educational interest.

5.3.6 a) Strategic Research Plan - Canada Research Chairs Program

StFX is planning a new science building which will house three of the University's Canada Research Chairs (CRCs). The Academic Priorities and Planning Committee (APPC), of StFX identified seven existing areas of research strengths for enhancement over the next five years through the CRC program. One of the seven Research Thrusts for CRCs is in aquatic ecology which is allied with the Biology Department.

5.3.6 b) Social Research for Sustainable Fisheries (SRSF)

SRSF is a Community-University Research Alliance (CURA) based out of Antigonish (NS) that partners Mi'kmaq and non-native fish harvesters organizations with StFX University's research capacity and know-how as well as with the research and educational expertise affiliated with Interdisciplinary Studies in Aquatic Resources (ISAR). A core purpose of the partnership is to develop applied research capacity within and research relations between marine harvesting community organizations and the university community.

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Conclusion

The Gulf Region has long supported the fisheries and culture of several molluscan species such as Blue mussels, clams, and American oysters, the specie of interest in this profile.

As we have seen, the American oyster is the second most important bivalve mollusc landed in the Gulf Region and this, not only in term of landed value, but also in term of employment. Adding the oyster fishers (3,168) and the leaseholders not registered as commercial oyster fishers and their employees, there are over 3,500 people directly engaged in oyster fishing and/or aquaculture activities.

Prince Edward Island is the leading oyster producer in the Gulf Region, accounting for more than 86% of total landings. However, it is worthwhile to note that oyster aquaculture in Eastern NB is an emerging industry with around 17 (46%) of oyster operations having less than 5 years of operation. Recent projection indicates that the value of cocktail and commercial oyster production together will be worth around $2.8 million in 2003, $11.8 million in 2005, and $16.7 million in 2010, of which around 50%, 33% and 38% respectively will be from cocktail oysters alone. Therefore, great effort for the marketing of oyster cocktail in the years to come will be necessary in order to sell what will be produced. In the Gulf Region in general, further development of the oyster aquaculture industry will also need to insure the continuance of its co-existence with other stakeholders.

Moreover, regulations and programs to manage and conserve the resource, as well as to protect the industry and the public at large are continuously being improved. Numerous collaborative aquaculture and bivalve shellfish researches and developments are also happening in and around the Gulf Region. All of this will continue to increase scientific capacity and help support, as well as improve the competitiveness of the oyster industry in the Gulf Region.

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APPENDICES

Appendix 1

Gulf Region Statistical District Boundaries

Gulf Nova Scotia Statistical District	Geographical Boundary
01	Meat Cove to Bay St. Lawrence
02	Victoria County to Broad Cove
03	Broad Cove (inclusive) to Richmond County
10	Cumberland County to Pictou County (Gulf Side)
11	Colchester County to the western shore of Pictou Harbour (inclusive) and including Pictou Island
12	Inclusive of the eastern shore of Pictou Harbour to the Antigonish County
13	Antigonish County (all)
14	Auld's Cove
45	New Brunswick border (Northumberland Strait) to Pugwash point (inclusive)
46	Pugwash point (exclusive) to Colchester County

Gulf New Brunswick Statistical District	Geographical Boundary
63	Restigouche County (all)
64	Restigouche County to Bass River (inclusive)
65	Bass River (exclusive) to Pokesudie Island (inclusive)
66	Shippegan and Miscou Islands (inclusive)
67	Pokesudie Island (exclusive) to Pokemouche Gully (inclusive)
68	Pokemouche Gully (exclusive) to Northumberland County
70	Gloucester County to Grand Down Island (inclusive)near Barryville
71	Grand Down Island (exclusive) to Morrissy Bridge on the north side of the Miramichi River and from Morrissy Bridge to Point au Carr (inclusive) on the south side of the Miramichi River
72	Morrissy Bridge to Red Bank (inclusive) on the north west Miramichi and from Morrissy Bridge to Quarryville (inclusive) on the south west Miramichi River
73	Point au Carr (exclusive) to Kent County
75	Northumberland County to the south side of the St. Louis River (exclusive)
76	South side of the St. Louis River (inclusive) to Chockpish River (inclusive)
77	South side of Chockpish River (exclusive) to Westmorland County
78	Kent county to Lower Cape Bald (inclusive)
80	Lower Cape Bald (exclusive) to Nova Scotia boundary on the

Northumberland Strait side

Prince Edward Island Statistical District	Geographical Boundary
82	Baptist (inclusive) to North Point (exclusive)
83	Percival River to Queens County Line at Victoria Harbour
85	Prince County to the western outskirts of Charlottetown, Northumberland Strait side
86	East Charlottetown (Southport) to Kings County Line (Little Sands) exclusive
87	All of Kings County south of a line from the coast at the south side of Boughton Bay to a line between Queens and Kings Counties
88	Kings County Line (Savage Harbour) inclusive to north side of Boughton River
92	North Point (inclusive) to Cavendish Inlet
93	Foxley Bay exclusive to Queens County Line
95	Prince County Line to Brackley Beach inclusive
96	Brackley Beach exclusive to Kings County Line (Savage Harbour) exclusive

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Appendix 2

POLICY RESPECTING THE HARVEST AND MARKETING OF "COCKTAIL" OYSTERS BY LICENSED AQUACULTURISTS IN NEW BRUNSWICK, NOVA SCOTIA AND PRINCE EDWARD ISLAND

INTRODUCTION

This policy was developed as a result of requests from aquaculturists[1] in New Brunswick and Nova Scotia to be permitted to harvest and market undersized "cocktail"[2] oysters from licensed shellfish leases. This policy was developed by the Department of Fisheries and Oceans (DFO) in consultation with the provinces involved. This policy takes into consideration health and safety concerns, enforcement requirements to ensure protection of commercial oyster fisheries and the need to harmonize implementation among the three provinces and the various areas within DFO's Maritimes Region. In New Brunswick, DFO and the province conducted a pilot project that permitted the harvest and marketing of cocktail oysters from selected oyster leases under strict guidelines during 1993 and 1994. This policy draws heavily on the experience gained in this pilot project.

POLICY

The policy applies in New Brunswick, Nova Scotia and Prince Edward Island unless otherwise indicated.

1. **The harvest and marketing of cocktail oysters will be permitted** from selected, licensed shellfish leases under *variation orders* issued by DFO. A variation order will permit the harvest and subsequent marketing of oysters of any size from a specific site during the periods specified in the order. All rules governing the program will be articulated in both an attachment to the variation order and the provincial (or federal) Aquaculture Lease Agreement of the proponent.

2. The marketing of cocktail oysters will be subject to the health and safety requirements of the *Fish Inspection Act and Regulations*.

3. All cocktail oysters must be processed in provincially licensed and registered plants when marketed in the province of origin. If being exported outside the province of origin, cocktail oysters must be processed in federally registered plants that have valid Quality Management Programs (QMP).

4. Licensees for the "Cocktail" Oyster Program will be selected based on the following criteria:

   a) Only those aquaculturists not holding commercial oyster licences or licences issued under the *Management of Contaminated Fisheries Regulations* (e.g., public bed relay or harvesting permits) will be eligible. Submission of a written application to the program will signify a proponent's desire to terminate any commercial licences if and when they are accepted into the program.

   Note: This criterion also applies to any helpers who will be engaged in the program; they will not be permitted to participate in commercial licensed oyster fisheries while deriving economic benefit (or sweat equity) from this program.

   b) Aquaculturists engaged in this program will be permitted to hold oyster replanting licences under Section 29 of the *Maritime Provinces Fishery Regulations* only under strict guidelines administered by the DFO Area Office. These licences **cannot** be valid during the period that the harvesting and marketing of cocktail oysters is permitted.

   c) Only those aquaculturists who comply with the terms and conditions set out in federal and provincial fisheries legislation and policy will be eligible.

   Note: If there are any inconsistencies between federal and provincial legislation or policy relating to this program, federal legislation or policy will prevail.

   d) Only those aquaculturists who can establish that they are the holders of licensed and surveyed shellfish leases that conform to the criteria of the leasing authorities in each province will be eligible. The leases must also be registered for cocktail oysters with the provincial leasing authority.

   Note: This is necessary to ensure that the fishing of cocktail oysters is conducted on private leases and not on public oyster beds. Developmental leases recognized by provincial leasing authorities are eligible for this program. The local variation order requires that geographic coordinates (grid references or latitude and longitude) be available for all points of the lease to properly describe the site. These must be available from the leasing authority.

IMPLEMENTATION PROCEDURES

1. a) Cocktail oysters being shipped to market **must** be contained in appropriately sized containers and tagged so they will be tamper-proof while en route to buyers. A record of product and amount **must** accompany all shipments and be maintained by the processor in a format that can be audited by the authorities. The units or volume of all transactions (sales and purchases) must be in a uniform measure and recorded so that they can be audited against growers' sales records to the processors.

   b) Under the program, the same uniform measure (units or volume) records of all shipments and sales to processors must be maintained by the aquaculturist in a format that can be audited by the authorities.

2. Any aquaculturist who fails to abide by the conditions of this policy or the terms and conditions of any federal or provincial licence or lease respecting the harvest and marketing of cocktail oysters will have their variation orders immediately revoked. This will result in the termination of the harvesting and marketing of cocktail oysters under this policy.

3. Any aquaculturist who accepts oysters less than 76 mm long onto their site, except in accordance with this policy, will have their variation orders immediately revoked.

4. Any aquaculturist who violates any provision of this policy or the conditions of any federal or provincial licence or lease may be subject to the loss or suspension of their provincial or federal shellfish licence or lease.

5. Any processor who fails to abide by the conditions of this policy or the terms and conditions of any federal or provincial licence or lease respecting the

harvest and marketing of cocktail oysters will have their variation orders immediately revoked. This will result in the termination of the harvesting and marketing of cocktail oysters under this policy.

6. The licensing authorities will carry out an immediate review if a processor is suspected of violating any provision of this policy or the conditions of any federal or provincial licence. If it is determined that a violation has been committed, offenders may be subject to the loss or suspension of their provincial or federal shellfish licence or their participation in the Quality Management Program.

7. Processors who must "hold" oysters outside of their physical processing facility on open water shellfish leases must, as part of the program, identify the licensed and surveyed leases that will be **used** only for holding cocktail oyster product. Other species may be held on the same lease, but must be identified in the application for the program.

   Note: No other oysters originating from the public or leasehold commercial fishery can be placed or held on the leases identified as part of the program.

GENERAL PROCEDURES

1. Any oyster aquaculturists desiring to become involved in the "Cocktail" Oyster Program must request permission to harvest and market cocktail oysters from the DFO Regional Aquaculture Coordination Office in Halifax or Moncton by submitting a completed and signed application. In their applications, aquaculturists must be prepared to identify all the information requested as part of the application, including the federally or provincially registered plant that will be processing or exporting the oysters.

2. DFO will investigate, review and vet the request through the provincial authorities to determine whether applicants meet the criteria for inclusion in the program and are in good standing with the authorities.

3. After a thorough review of the application with the provinces, the DFO Regional Aquaculture Coordination Office will inform applicants, in writing, whether they meet the criteria established in this policy.

4. The provinces (New Brunswick, Nova Scotia and Prince Edward Island) **must** recommend approval of applications for DFO to issue a variation order permitting cocktail oysters to be harvested from the specific lease and processed through the appropriate facility.

5. The information required as part of the official application will be identified in a form and include, but not be limited to, the following:

   (a) the name of the aquaculturist;

   (b) the location of the properly surveyed lease as approved by leasing authorities (must include either grid references or latitude and longitude for all points of the lease);

   (c) the period requested to harvest cocktail oysters;

   (d) the source of the seed that will be used by the aquaculturist as part of the program;

   (e) the name of the processing facility that will be shipping the product to the buyers/market;

   (f) a list of all staff (helpers) who will be engaged or employed by the applicant;

   (g) a copy of all harvesting and shipping labels and tamper-proof packaging that will be used by the aquaculturist and processor; and

   (h) an example of the record-keeping method and accounting procedure that will be used by both the aquaculturist and the processor to document the product from harvest site to market.

6. Current lists of participants will be maintained by DFO and made available to those fishery officers and inspection officers involved with the enforcement of this policy and program.

7. Oyster aquaculturists participating in the "Cocktail" Oyster Program must grow their own oysters from spat[3] or seed[3] that is either collected on site or at off site areas which are defined for spat collection in order to avoid user-group conflicts, if required. They can also be purchased from an identified seed and spat supplier[4] . Aquaculturists must be prepared to identify and keep an accurate record and inventory of seed and spat and from which sources they will be procured for grow-out.

DEFINITIONS

[1] Aquaculturists - holders of shellfish leases and licensed sites in the provinces of New Brunswick, Nova Scotia or Prince Edward Island, who grow their own oysters from spat or seed collected on site or off site, or purchased from an identified seed supplier or hatchery.

[2] "Cocktail" oysters - oysters less than 76 mm (3 inches) long. Cultured oysters longer than 76 mm are of legal (commercial) size and are not subject to this policy, but may still be considered an aquaculture product.

[3] Seed or spat oysters - oysters less than 51 mm (2 inches) long. For seed oysters purchased as part of this program that are longer than 51 mm, aquaculturists will require permission from DFO before any sales transaction or the movement of the seed between vendor and purchaser.

[4] Suppliers of seed for the program must be registered with DFO and provincial authorities as seed/ spat vendors, and must clearly identify their seed-holding sites or leases involved in the program. Hatcheries supplying seed for the program must be licensed facilities in their respective provinces.

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Appendix 3 Canadian Oyster Export Values (thousands of dollars) by Destination, Maritime - 1991 - 2001

Canadian Oyster Export[1] Values (thousands of dollars) by Destination, Maritime - 1991

Destination	PEI		NS		NB		TOTAL	
	$000	% of Total	$000	% of Total	$000	% of Total	$000	% of Total
United States	985	95.3%	122	100%	149	100%	1,256	96.3%
Luxembourg	31	3.0%	-	-	-	-	31	2.4%
Belgium	2	0.2%	-	-	-	-	2	0.1%
St. Pierre-Miquelon	13	1.3%	-	-	-	-	13	1.0%
Germany	2	0.2%	-	-	-	-	2	0.2%
TOTAL	**1,033**	**100%**	**122**	**100%**	**149**	**100%**	**1,304**	**100%**

Destination	PEI		NS		NB		TOTAL	
	$000	% of Total	$000	% of Total	$000	% of Total	$000	% of Total
United States	700	96.6%	73	87.2%	63	100%	836	97.0%
Luxembourg	21	2.8%	-	-	-	-	21	2.4%
St Pierre-Miquelon	4	0.6%	1	0.9%	-	-	5	0.6%
Sub-Total	725	100%	74	88.1%	63	100%	862	100%
Others	-	-	10	11.9%	-	-	-	-
TOTAL	**725**	**100%**	**84**	**100%**	**63**	**100%**	**862**	**100%**

Canadian Oyster Export[1] Values (thousands of dollars) by Destination, Maritime - 1993

Destination	PEI		NS		NB		TOTAL	
	$000	% of Total	$000	% of Total	$000	% of Total	$000	% of Total
United States	1,252	98.6%	49	79.9%	5	100%	1,307	97.7%
St Pierre-Miquelon	14	1.1%	-	-	-	-	14	1.1%
France[2]	-	-	9	14.0%	-	-	9	0.6%
Belgium	4	0.3%	-	-	-	-	4	0.3%
Denmark	-	-	3	5.2%	-	-	3	0.2%
Sub-Total	1,270	100%	61	99.1%	5	100%	1,337	99.96%
Others	-	-	1	0.9%	-	-	1	0.04%
TOTAL	**1,270**	**100%**	**62**	**100%**	**5**	**100%**	**1,337**	**100%**

Canadian Oyster Export[1] Values (thousands of dollars) by Destination, Maritime - 1994

Destination	PEI		NS		NB		TOTAL	
	$000	% of Total	$000	% of Total	$000	% of Total	$000	% of Total

United States	1,383	99.7%	119	70.3%	40	98.9%	1,543	96.6%
St Pierre-Miquelon	4	0.3%	23	13.5%	-	-	27	1.7%
France[2]	-	-	15	8.9%	-	-	15	0.9%
Denmark	-	-	6	3.6%	-	-	6	0.4%
Hong Kong	-	-	-	-	0.5	1.1%	0	0.0%
Sub-Total	1,387	100%	163	96.3%	41	100%	1,591	99.6%
Others	-	-	6	3.7%	-	-	6	0.4%
TOTAL	**1,387**	**100%**	**170**	**100%**	**41**	**100%**	**1,598**	**100%**

Canadian Oyster Export[1] Values (thousands of dollars) by Destination, Maritime - 1995

Destination	PEI		NS		NB		TOTAL	
	$000	% of Total	$000	% of Total	$000	% of Total	$000	% of Total
United States	1,609	98.1%	35	70.2%	49	100%	1,694	97.4%
St Pierre-Miquelon	31	1.9%	11	21.9%	-	-	42	2.4%
France[2]	-	-	4	7.9%	-	-	4	0.2%
TOTAL	**1,640**	**100%**	**50**	**100%**	**49**	**100%**	**1,739**	**100%**

Canadian Oyster Export[1] Values (thousands of dollars) by Destination, Maritime - 1996

Destination	PEI		NS		NB		TOTAL	
	$000	% of Total	$000	% of Total	$000	% of Total	$000	% of Total
United States	1,411	100%	124	96.2%	20	100%	1,554	99.7%
Germany	-	-	5	3.8%	-	-	5	0.3%
TOTAL	**1,411**	**100%**	**128**	**100%**	**20**	**100%**	**1,559**	**100%**

Canadian Oyster Export[1] Values (thousands of dollars) by Destination, Maritime - 1997

Destination	PEI		NS		NB		TOTAL	
	$000	% of Total	$000	% of Total	$000	% of Total	$000	% of Total
United States	1,418	100%	145	92.8%	13	100%	1,576	99.3%
Belgium	-	-	11	7.2%	-	-	11	0.7%
TOTAL	1,418	100%	156	100%	13	100%	1,587	100%

Canadian Oyster Export[1] Values (thousands of dollars) by Destination, Maritime - 1998

Destination	PEI		NS		NB		TOTAL	
	$000	% of Total	$000	% of Total	$000	% of Total	$000	% of Total
United States	2,034	100%	270	59.4%	93	100%	2,396	92.9%
United Kingdom	-	-	128	28.1%	-	-	128	4.9%
Belgium	-	-	45	9.9%	-	-	45	1.7%
St Pierre-Miquelon	-	-	12	2.6%	-	-	12	0.5%
TOTAL	2,034	100%	454	100%	93	100%	2,581	100%

Canadian Oyster Export[1] Values (thousands of dollars) by Destination, Maritime - 1999

Destination	PEI		NS		NB		TOTAL	
	$000	% of Total	$000	% of Total	$000	% of Total	$000	% of Total
United States	3,225	100%	668	86.1%	19	100%	3,913	97.3%
Hong Kong	-	-	59	7.6%	-	-	59	1.5%
St Pierre-Miquelon	-	-	19	2.5%	-	-	19	0.5%
France[2]	-	-	16	2.1%	-	-	16	0.4%
Belgium	-	-	13	1.7%	-	-	13	0.3%
TOTAL	3,225	100%	776	100%	19	100%	4,021	100%

Canadian Oyster Export[1] Values (thousands of dollars) by Destination, Maritime - 2000

Destination	PEI		NS		NB		TOTAL	
	$000	% of Total	$000	% of Total	$000	% of Total	$000	% of Total
United States	5,739	100%	1,130	95.7%	34	100%	**6,902**	**99.3%**
Singapore	-	-	21	1.8%	-	-	**21**	**0.3%**
Belgium	-	-	18	1.5%	-	-	**18**	**0.3%**
Iceland	-	-	11	1.0%	-	-	**11**	**0.2%**
TOTAL	**5,739**	**100%**	**1,180**	**100%**	**34**	**100%**	**6,953**	**100%**

Canadian Oyster Export[1] Values (thousands of dollars) by Destination, Maritime - 2001

Destination	PEI		NS		NB		TOTAL	
	$000	% of Total	$000	% of Total	$000	% of Total	$000	% of Total
United States	4,306	100%	853	78.5%	23	100%	**5,182**	**95.7%**
France[2]	-	-	192	17.7%	-	-	**192**	**3.6%**
Cuba	-	-	30	2.7%	-	-	**30**	**0.6%**
Iceland	-	-	12	1.1%	-	-	**12**	**0.2%**
TOTAL	**4,306**	**100%**	**1,087**	**100%**	**23**	**100%**	**5,417**	**100%**

Notes:

[1] Include Domestic Exports only, which consist of the exports of all goods grown, produced, extracted or manufactured in the country, leaving the country for a foreign destination. Exports of imported merchandise which has been substantially enhanced in value are also included. Note that exports leaving one province does not necessarily mean that these products were captured or processed in that province.

[2] Includes Monaco and French Antilles.

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